

#28/43
1/28/02

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re PATENT APPLICATION of
Inventor(s): Mills

App'n Ser. No.: 09/009,837

Filing Date: 1/20/1998

Title: HYDRIDE FUEL AND EXPLOSIVE



Group Art Unit: 1754

Examiner(s): Langel for the
Secret Committee

January 22, 2002

(January 20, 2002 = Sunday; January 21, 2002 = Holiday)

RESPONSE AFTER FINAL UNDER RULE 116

Hon. Asst. Commissioner of Patents and Trademarks
Washington, D.C. 20231

Sir:

Applicant files this Response to the procedurally defective Final Office Action mailed July 20, 2001, **UNDER PROTEST** due to the suspicious circumstances under which the subject application has been examined and rejected in secret after five of his other applications were unlawfully withdrawn from issue and then reexamined, also in secret, after having been allowed. These circumstances have resulted in four U.S. Senators requesting that Senator Patrick Leahy, Chairman of the Judiciary Committee overseeing the PTO, and/or Commerce Secretary Donald Evans, look into this matter.

The July 20 Final Action is also fatally defective on the merits in rejecting all pending claims 17-299 on the erroneous basis that the disclosed invention is inoperative under 35 U.S.C. § 101 and non-enabling under § 112, first paragraph, without fully and fairly considering Applicant's overwhelming experimental evidence to the contrary.

These highly improper actions go beyond the ordinary rejection of claims, having caused real economic hardship to Applicant, Dr. Randell L. Mills, and his company, BlackLight Power, Inc. Such hardship includes an almost two-year delay in BlackLight's scheduled IPO through Morgan Stanley Dean Witter and the undue expense of litigating against the PTO for their unlawful acts.

For these and other reasons explained more fully below, Applicant respectfully requests that the July 20 Final Action be immediately withdrawn so that all claims can be allowed to issue.

I. Introduction

The original examiner assigned to this case, Wayne Langel, advanced precisely the same statutory grounds of rejection now under consideration in three of Applicant's five withdrawn applications, but after evaluating the experimental evidence submitted by Applicant, allowed all of the pending claims. But for the PTO's unlawful withdrawal of those five allowed applications from issuance in violation of 35 U.S.C. § 151, 37 C.F.R. § 1.131(b), and M.P.E.P. § 1308, they each would have issued as U.S. Patents, as would this case.

The PTO has steadfastly refused to fully disclose the true facts and circumstances surrounding its withdrawal action, which has had a profound effect on the subject application. Such refusal has only raised further questions as to who and what precipitated that action. Applicant's suspicion that competitors may have played a role were fueled by the discovery that officials from the State Department and the American Physical Society (APS)—one having a "Deep Throat" contact in the Patent Office—may have been involved in subverting Applicant's patent rights. Those suspicions were heightened by the PTO's further refusal to identify the members of the newly-formed "Secret Committee" that replaced Examiner Langel, or any other persons involved in examining this case and Applicant's other, withdrawn applications.

As explained more fully below, the PTO's failure to provide this information has handicapped Applicant's ability to respond to and overcome the Final Rejections of record. Applicant nonetheless makes a good-faith effort to refute, point by point, the bases for those rejections contained in the Secret Committee's 71-page Final Office Action.

Notably, the Committee devotes a significant portion of that Action attacking Applicant's theory that underlies the claimed invention and predicts the formation of lower-energy hydrogen, i.e., "hydrinos." In response to those attacks, Applicant cites

his own extensive textbook and over 50 submitted articles, 34 of which have been peer-reviewed and either published or accepted for publication in highly-respected scientific journals. These publications support his theory, while exposing the shortcomings in the quantum theory principles the Committee uses to dismiss the existence of lower-energy hydrogen.

While debate over these competing theories can go on indefinitely, engaging in such an intellectual exercise will not, indeed cannot, definitively settle the question of whether or not hydrinos exist. Like any theoretical question, this one can only be tested and ultimately settled by fairly analyzing the unprecedented amount of experimental evidence Applicant has submitted—costing tens of millions of dollars to produce—that conclusively confirms the existence of lower-energy hydrogen.

The Secret Committee's approach to examining Applicant's novel hydrogen chemistry, however, is completely backwards. It uses its own distorted views of quantum theory to invalidate and, thus, ignore Applicant's real-world experimental evidence, rather than looking to see whether that evidence, in fact, validates Applicant's competing theory.

To the limited extent that the Committee addresses some of Applicant's evidence, it goes to extremes in finding ridiculous excuses to dismiss it out of hand. Applicant has seen this unscientific approach used before by Committee Member Vasudevan Jagannathan at an Interview, during which he flippantly discounted extraordinarily reliable spectroscopic data—amounting to a “chemical fingerprint”—as nothing more than “a bunch of squiggly lines.”

Apparently, members of the PTO's Secret Committee believe they are better qualified than the highly-skilled PhD's who have contributed to Applicant's work¹ and the other skilled PhD's who have peer-reviewed that work and confirmed that his hydrogen chemistry does, in fact, produce lower-energy hydrogen. Those members, therefore, should be required to identify themselves and their associations with anyone else

¹ See biographies of BlackLight PhD scientists (Attachment 62). Note that Attachment Nos. 1-61 were previously submitted with Applicant's March 12, 2001 Response to the Secret Committee's September 11, 2000 Office Action, which Response and Attachments are incorporated herein by reference.

connected to the examination of BlackLight's applications so that the credentials and interests of those involved in the ultimate patentability decision can be properly evaluated.

In another disturbing development, further hindering efforts to overcome the rejections of record, the Secret Committee waited until its Final Action to discuss but a small fraction of the evidentiary and theoretical support for Applicant's disclosed invention, thereby raising new grounds of rejection that were improperly made Final.

Despite this procedural misstep, Applicant responds in good faith to these new grounds of rejection, including the submission of yet additional experimental evidence of hydrino formation addressing the Committee's belated comments.

II. The Final Action Has Been Unlawfully Entered and Therefore Should Be Withdrawn Immediately to Allow All Claims to Issue

As noted in Applicant's previous Response, filed March 12, 2001, the PTO's withdrawal of his five applications from issuance and subsequent rejection of previously allowed claims after payment of the Issue Fee violated 35 U.S.C. § 151, 37 C.F.R. § 1.131(b), and M.P.E.P. § 1308. Were it not for the events that triggered that unlawful withdrawal action, it is unlikely that this case would be at this stage of the proceedings, but rather, would have been allowed and ultimately issued as a patent.² Accordingly, Applicant files this Response under protest, demanding that the PTO immediately issue the subject application as a U.S. patent.

The present claims are allowable for precisely the same reasons that Examiner Langel previously allowed the claims in Applicant's withdrawn applications. After thoroughly considering Applicant's arguments and experimental evidence supporting the operability of Applicant's novel hydrogen chemistry, Examiner Langel properly determined that Applicant was legally entitled to a patent in each of those cases and properly issued a written Notice of Allowance to that effect. In response, Applicant paid

² Indeed, the Secret Committee issued the identical 68-page Attachment in each of Applicant's withdrawn applications and the present case.

the Issue Fee fully expecting the PTO to comply with 35 U.S.C. § 151, which directs that, upon such payment, “the patent shall issue.”³

The PTO, however, ignored that statutory directive and unlawfully withdrew the five allowed applications from issue merely to reconsider whether the claims were patentable, which action not only resulted in the entry of the pending Final Office Actions in those cases, but in this one as well. Even assuming the PTO had the proper statutory authority to withdraw those other five applications under Section 151—which it did not—its withdrawal action occurred under extremely suspicious circumstances that further violated 37 C.F.R. § 1.313(b).⁴

This regulation provides in pertinent part that once the Issue Fee has been paid, an allowed application can be withdrawn only if the PTO first makes an actual determination of “unpatentability of one or more claims.” Indeed, the PTO’s own procedural guidelines for administering Section 1.313(b)—the best authority for interpreting that regulation—prohibit withdrawing an application from issue after payment of the Issue Fee “to permit the examiner to consider whether one or more claims are unpatentable.” See M.P.E.P. § 1308 (7th Ed., Rev. 1, Feb. 2000). Rather, “only if such consideration results in a determination that one or more claims are unpatentable does 37 CFR 1.313(b) authorize the application to be withdrawn from issue.” [*Id.*] The PTO has not shown that it even reviewed the claims of Applicant’s withdrawn applications—much less determined their patentability or unpatentability—prior to instituting its procedure to pull those applications from issue.⁵

³ Note that emphasis in authorities cited throughout this Response has been added unless otherwise indicated.

⁴ These and other arguments made herein are more fully detailed in the briefs filed in the pending appeal to the Federal Circuit in *BlackLight Power, Inc. v. Q. Todd Dickinson*, Appeal No. 00-1530. [See Attachment 52] The Federal Circuit has now heard this appeal, argued on behalf of BlackLight by Donald R. Dunner, Esq. of Finnegan, Henderson, Farabow, Garrett & Dunner.

⁵ Indeed, in its March 22 Decision on Petition regarding BlackLight’s co-pending application Serial No. 09/009,294, the PTO indicated that the allowed claims of that application, in fact, might be patentable, noting that “[t]he PTO will issue in due course either a supplemental notice of allowance or an office action rejecting the claims.”

Thus, the PTO had no valid legal basis under 35 U.S.C. § 151, 37 C.F.R. § 1.313(b), and M.P.E.P. § 1308 for issuing any Office Actions in the withdrawn applications once the Issue Fee had been paid. Applicant therefore demands that the Secret Committee not only immediately withdraw its Final Actions unlawfully entered in those cases so that each can be allowed to issue as a U.S. Patent, but that it also withdraw the Final Action in the subject case that otherwise would never have been entered.

III. The PTO's Failure to Provide Essential Information has Handicapped Applicant's Ability to Respond to and Overcome the Final Office Action

The PTO's unlawful withdrawal of BlackLight's five other applications is also suspect in view of its steadfast refusal to fully disclose the true facts and circumstances as to who and what precipitated it. This information is vital to effectively weigh and counter the arguments presented in the Secret Committee's 71-page Final Office Action entered in this case, which effectively resulted from that withdrawal action.

Immediately following this incident, counsel began investigating the facts and circumstances surrounding it by questioning various PTO personnel. In the course of that investigation, Director Esther Keplinger admitted to counsel that she withdrew the applications in reaction to perceived heat—a "firestorm" as she put it—the PTO had received from an undisclosed outside source. Director Keplinger further indicated that the withdrawal occurred only after BlackLight's earlier-issued U.S. Patent No. 6,024,935 ("the '935 patent") had been brought to the attention of Director Dickinson by Gregory Arahorian, another PTO outsider well known for his public attacks on issued U.S. patents.⁶

Applicant believes he is entitled to a full accounting of how, out of the thousands of patents the PTO issues on a weekly basis, his '935 patent happened to come to its

⁶ These outrageous events, in effect, created a non-statutory reexamination procedure for opposing the issuance of patents never envisioned by Congress. *Compare* 35 U.S.C. §§ 301-307 (patent reexamination statutes).

attention, thus leading to the withdrawal of other allowed BlackLight applications. Unfortunately, attempts by Applicant to learn more about these and other events have been stymied. The PTO's less than forthcoming approach in dealing with this matter was succinctly expressed by Solicitor Baer in his comments to District Court Judge Emmet G. Sullivan:

I would even say, Your Honor, you could imagine in our head any scenario of how we learned about [the '935 patent]. A blimp flying over us. It doesn't matter, because what matters, Your Honor, is the decision [to withdraw] itself. [*BlackLight Power, Inc. v. Q. Todd Dickinson*, May 22, 2000 Tr. at 52 (Attachment 54 at Tab E)]

Apparently Judge Sullivan, like Applicant, was unimpressed by those comments, as he noted in footnote 10 of his Opinion that he was "troubled by several steps in the PTO's process." He further advised the PTO to "examine its patent issuance process so that their normal operations are not compromised by such seemingly suspicious procedures." [Op. at 25 (Attachment 63)]

Further fueling Applicant's suspicions that the withdrawal of his applications might have been caused by competitors interfering with his valuable patent rights were the actions of Dr. Peter Zimmerman, former Chief Scientist for the State Department. Applicant learned that Dr. Zimmerman had published an Abstract of an upcoming speech to the American Physical Society (APS), a BlackLight competitor, boasting that his Department and the Patent Office "have fought back with success" against BlackLight. [See Attachment 54 at Tab C] In subsequent conversations with Applicant's counsel, Dr. Zimmerman admitted to receiving information concerning BlackLight's applications through e-mails from APS spokesman Dr. Robert Park, who told him of a contact in the PTO referred to by Dr. Park as "Deep Throat." [See Attachment 54 at Tab C]

If true, these actions would clearly violate the PTO's duty to maintain confidentiality of U.S. patent applications under 35 U.S.C. § 122, 18 U.S.C. § 2071, 37 C.F.R. § 1.14, M.P.E.P. § 101.⁷ Even more distressing is the possibility that patent

⁷ Applicant has advised the PTO of a possible breach of confidentiality, including improper disclosures to

rights to Applicant's novel hydrogen chemistry may have been compromised by a group of physicists with a vested interest in maintaining federal funding for projects based on a competing scientific theory.

Suspensions that competitors may have precipitated withdrawal of BlackLight's applications from issue were only heightened by the PTO's subsequent actions in replacing the original Examiners, Langel and Kalafut, with a "Secret Committee" to reject claims in all of BlackLight's applications, including this one, while refusing to fully identify its members, or any other persons, involved in the examination process.⁸

Amazingly, the PTO has thwarted similar inquiries made on Applicant's behalf by five U.S. Senators. [See letters to and from Senators Max Cleland, Robert Torricelli, Jon Corzine, Ron Wyden, and Gordon Smith (Attachment 64)] Due to the PTO's stonewalling, four of those Senators have now formally requested that the Chairman of the Judiciary Committee that oversees the PTO, Senator Patrick Leahy, and/or the Secretary of Commerce, Donald Evans, look into this matter. [See letters from Senators Cleland, Wyden, Torricelli, and Corzine (Attachment 65)]

Clearly, knowing the identity and qualifications of all persons providing input or otherwise participating in the examination of this application and the non-statutory reexamination of BlackLight's five withdrawn applications, especially those with competing interests, bears directly on the credibility of the positions articulated in rejecting claims in those cases. Furthermore, knowing who is responsible for deciding the fate of these applications so that those persons can be addressed directly would

Dr. Zimmerman, Dr. Park, and other non-PTO personnel. [See January 19, 2001 letter to Kepplinger (Attachment 54)]. Surprisingly, the PTO has yet to indicate the extent to which confidentiality of BlackLight's applications may have been unlawfully breached, or even that it has begun looking into this matter.

⁸ Because the Section 101 and 112, first paragraph, rejections contradicted the prior positions that Examiners Langel and Kalafut had taken in allowing the claims of BlackLight's withdrawn applications, Applicant knew they did not author those rejections despite their signing the Office Actions that issued them. Examiners Langel and Kalafut confirmed as much, revealing for the first time that members of a newly-formed committee had taken control of examining BlackLight's applications in secret. One of those Secret Committee members involved in this examination was identified as Examiner Vasudevan Jagannathan. [See January 19, 2001 Letter to Director Kepplinger (Attachment 54)].

also greatly assist Applicant in more effectively responding to and overcoming the rejections of record.

Thus, when Applicant first learned that Examiner Jagannathan was somehow involved in the Secret Committee's clandestine work, counsel immediately contacted him to confirm his role and identify any other sources of Committee activity. In a confrontational tone, Examiner Jagannathan flatly refused to admit any such role or to answer any other relevant questions relating to the then-pending Office Actions.⁹ Worse yet, he further refused to even attend an Interview with Applicant and his counsel, scheduled for February 21, 2001, to see if an agreement could be reached over patentability of the claimed inventions.

Examiner Jagannathan ultimately did appear at the February 21 Interview, but only after being ordered to do so by his immediate supervisor, to whom Applicant had complained.¹⁰ [See January 19, 2001 letter to Director Kepplinger (Attachment 54) and February 12, 2001 Letter from Director Jacqueline M. Stone (Attachment 55)] The Interview, however, almost ended as soon as it began when counsel requested full identification of those persons responsible for examining Applicant's pending applications. Based upon the absurd contention that such information was not germane to the examination, Examiner Jagannathan became quite hostile in his threat to adjourn the Interview if counsel inquired any further into that subject.

Ironically, it was only because counsel forced Examiner Jagannathan to admit his Secret Committee role in rejecting Applicant's claims—a role he vigorously sought to

⁹ Examiner Jagannathan later admitted his involvement, although he has never identified himself as an Examiner-of-record in any BlackLight application, nor does his name otherwise appear in connection with any Office Action issued in those cases.

¹⁰ The original Examiners, Langel and Kalafut, also attended the February 21 Interview, but did not participate in the discussions. While they had signed the Office Actions that were the subject of the Interview, they admitted that the Secret Committee was essentially "pulling the strings" and, therefore, they had no influence over its decisions. Also in attendance were PTO Solicitors Stephen G. Walsh and Henry Sawtelle, who rebuffed counsel's attempts to ascertain the reason for their appearance other than to offer that they were there as "observers." Due to the unusual circumstances surrounding the proceedings, Senator Max Cleland, Chairman of the U.S. Senate's Commerce Subcommittee, had his personal representative, Donnie Turner, Esq., attend and observe the Interview.

conceal—that Applicant was able to learn some of the extreme positions the Committee holds in rejecting Applicant's claims. [See infra, Section "V.B."]

Simply put, Applicant is entitled to a fair hearing on the patentability of his pioneering hydrogen chemistry. Such entitlement includes the right to know the identity, qualifications, and true interests of everyone involved in making that determination and to confront such persons directly. Applicant therefore renews his previous request that the PTO immediately provide the following information:

- 1) Identification of all Examiners or other PTO personnel who were consulted, or otherwise provided input, in the examination of BlackLight's applications;
- 2) Identification of all outside consultants or other persons, including, but not limited to, NIST employees, who were consulted, or otherwise provided input, in the examination of BlackLight's applications;
- 3) Identification of all PTO officials responsible for withdrawing BlackLight's five allowed applications from issuance and a complete disclosure of the facts and circumstances surrounding that withdrawal action; and
- 4) Identification of all outside sources of information who may have precipitated, or otherwise contributed to, the PTO withdrawing BlackLight's five allowed applications from issuance and a complete disclosure of the facts and circumstances surrounding those actions.

The PTO's inexcusable refusal to provide this critical information harms not only this one Applicant, but damages the honor and integrity of the entire patent system to the detriment of all patent applicants.

**IV. Applicant's Experimental Evidence Validates
the Formation of Lower-Energy Hydrogen**

The cavalier manner in which BlackLight's applications have been withdrawn and/or subjected to improper secret examination is further reflected in its defective Final Rejection of pending claims 17-299 as being inoperative under 35 U.S.C. § 101 and non-enabled under § 112, first paragraph, for the same reasons advanced in the identical 68 page Attachments to the outstanding Final Actions in the five withdrawn cases and the subject case.

Applicant has presented compelling experimental evidence confirming that his disclosed catalytic reaction of atomic hydrogen forms hydrogen in fractional quantum states at lower energies than the traditional ground state ($n=1$), *i.e.*, hydrinos. In its Final Rejection, the Committee unfairly concludes that the pending claims are unpatentable under Sections 101 and 112, first paragraph, without fairly considering that real-world evidence establishing the operability and enablement of Applicant's novel hydrogen chemistry.

Rather, the Secret Committee flat out ignores the vast majority of Applicant's experimental evidence in favor of arguments that Applicant's underlying theory, which predicts the formation of hydrinos, contradicts its own firmly-held theories. Applicant is certainly not adverse to debating these competing theories and provides an extensive discussion in the attached Appendix, with references cited therein, that refutes the Committee's theoretical musings point by point.¹¹

The Secret Committee should recognize, however, that there are limits to what this intellectual exercise can accomplish. The fundamental difference between the competing theories espoused by Applicant and the Secret Committee comes down to

¹¹ Applicant provides this discussion of the theoretical underpinnings of his novel hydrogen chemistry despite the fact that the U.S. patent laws do not require it. *See, e.g., Diamond Rubber Co. v. Consolidated Rubber Tire Co.*, 220 U.S. 428, 435-36 (1911); *In re Isaacs and Lindenmann*, 146 USPQ 193, 197 (CCPA 1965); *Tapco Prods. Co. v. Van Mark Prods. Corp.*, 170 USPQ 550 (6th Cir. 1971) (patent applicant need not understand necessarily how or why his invention works.)

the issue of whether or not lower-energy hydrogen exists.¹² The theoretical debate over that issue can go on indefinitely unless and until the Committee takes a serious look at Applicant's compelling experimental evidence, which ultimately settles this issue in his favor.¹³

Unfortunately, the Secret Committee's approach to examining the subject application seems to be that its distorted views of quantum theory justifies invalidating real-world experimental evidence without having to seriously examine that evidence and determine whether, in fact, it validates Applicant's competing theory. Such a backward approach, however, not only reflects a basic misunderstanding of fundamental scientific principles, but further demonstrates an obvious bias that unlawfully imposes on Applicant new standards of patentability.

A. Applicant's Novel Catalytic Reaction of Atomic Hydrogen

Applicant's experimental evidence supporting the formation of lower-energy hydrogen is based, in part, on studies of the disclosed catalytic reaction of atomic hydrogen for producing such lower-energy states as described below:

J. R. Rydberg showed that all of the spectral lines of atomic hydrogen were given by a completely empirical relationship:

¹² See, in particular, References 27, 28, 32, 39, and 45. Note that Dr. Mills' Declaration certifies the experimental evidence disclosed in these and other References cited herein. [See Attachment A to the Appendix] Note further that the References cited herein, which include Applicant's peer-reviewed publications that experimentally confirm lower-energy hydrogen as disclosed, are listed by corresponding number in the attached compilation of References. [See Attachment B to the Appendix] Regarding the list of Applicant's journal articles, it should be further noted that the description "in press" means that the article has been through rigorous peer review and that the additional experiments and changes required by the referees have been made and accepted by them and the Editors. "Submitted" means that Applicant and his 11 Ph.D.'s and other technical staff believe that the paper is scientifically correct, represents a significant scientific advancement, and will be published.

¹³ Much of this data has been derived from Applicant's working prototype energy cells that employ Applicant's catalytic process to produce lower-energy hydrogen. Applicant has made several overtures to various PTO officials to visit BlackLight's extensive 53,000-square-foot facility located in Cranbury, New Jersey. Most recently, Applicant invited the new PTO Director, James E. Rogan, for just such a visit so that he could witness firsthand the operation of BlackLight's prototype energy cells. [Attachment 66]]

$$\bar{\nu} = R \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right) \quad (1)$$

where $R = 109,677 \text{ cm}^{-1}$, $n_f = 1, 2, 3, \dots$, $n_i = 2, 3, 4, \dots$ and $n_i > n_f$. Bohr, Schrodinger, and Heisenberg each developed a theory for atomic hydrogen that gave the energy levels in agreement with Rydberg's equation.

$$E_n = -\frac{e^2}{n^2 8\pi\epsilon_0 a_H} = -\frac{13.598 \text{ eV}}{n^2} \quad (2a)$$

$$n = 1, 2, 3, \dots \quad (2b)$$

The excited energy states of atomic hydrogen are given by Eq. (2a) for $n > 1$ in Eq. (2b). The $n = 1$ state is the "ground" state for "pure" photon transitions (*i.e.*, the $n = 1$ state can absorb a photon and go to an excited electronic state, but it cannot release a photon and go to a lower-energy electronic state). However, an electron transition from the ground state to a lower-energy state may be possible by a resonant nonradiative energy transfer such as multipole coupling or a resonant collision mechanism. Processes such as hydrogen molecular bond formation that occur without photons and that require collisions are common.¹⁴ Also, some commercial phosphors are based on resonant nonradiative energy transfer involving multipole coupling.¹⁵

Applicant proposes that atomic hydrogen may undergo a catalytic reaction with certain atoms and ions such as He^+ which singly or multiply ionize at integer multiples of the potential energy of atomic hydrogen, $m \cdot 27.2 \text{ eV}$ wherein m is an integer. The reaction involves a nonradiative energy transfer to form a hydrogen atom that is lower in energy than unreacted atomic hydrogen that corresponds to a fractional principal quantum number. That is

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}; \quad p \text{ is an integer} \quad (2c)$$

¹⁴ Reference 61.

¹⁵ Reference 62.

replaces the well-known parameter $n = \text{integer}$ in the Rydberg equation for hydrogen excited states. The $n = 1$ state of hydrogen and the $n = \frac{1}{\text{integer}}$ states of hydrogen are nonradiative, but a transition between two nonradiative states is possible via a nonradiative energy transfer, say $n = 1$ to $n = 1/2$. Thus, a catalyst provides a net positive enthalpy of reaction of $m \cdot 27.2 \text{ eV}$ (i.e., it resonantly accepts the nonradiative energy transfer from hydrogen atoms and releases the energy to the surroundings to affect electronic transitions to fractional quantum energy levels). As a consequence of the nonradiative energy transfer, the hydrogen atom becomes unstable and emits further energy until it achieves a lower-energy nonradiative state having a principal energy level given by Eqs. (2a) and (2c).

B. Summary of Analytical Studies Experimentally Confirming the Formation of Lower-Energy Hydrogen

The central issue facing the Secret Committee is whether Applicant's disclosed catalytic reaction does, in fact, form lower-energy hydrogen as predicted by his underlying theory. The Committee recognizes as much in the following statement taken from its Final Office Action:

The [Secret Committee's] principal position is that applicant has failed to scientifically substantiate the very existence of the "hydrino atom" let alone its many alleged manifestations in the experimental data provided by the applicant. [July 20 Final Action, "Attachment to Response" at 6]

While the Secret Committee properly frames the issue to be decided in this case, it is flat wrong in its "principal position" that applicant has failed to scientifically substantiate the existence of hydrinos. To the contrary, Applicant has submitted a multitude of analytical studies experimentally confirming the disclosed novel reaction of atomic hydrogen, which produces hydrogen in fractional quantum states that are at lower energies than the traditional "ground" ($n = 1$) state, a chemically generated or assisted plasma (rt-plasma), and novel hydrino hydride compounds. These studies fall into the following general categories:

extreme ultraviolet (EUV) spectroscopy,¹⁶
characteristic emission from catalysis and the hydride ion products,¹⁷
lower-energy hydrogen emission,¹⁸
plasma formation,¹⁹
Balmer α line broadening,²⁰
elevated electron temperature,²¹
anomalous plasma afterglow duration,²²
power generation,²³ and
analysis of chemical compounds.²⁴

One skilled in the art would readily understand and be able to reproduce such real-world analytical studies, including the specific 42 studies of Applicant's lower-energy hydrogen technology described below that have been made of record in this case:

(1) the observation of intense extreme ultraviolet (EUV) emission at low temperatures (e.g. $\approx 10^3 K$) from atomic hydrogen and only those atomized elements or gaseous ions which provide a net enthalpy of reaction of approximately $m \cdot 27.2 eV$ via

¹⁶ References 1, 2, 12-18, 20-22, 25, 29, 33-35, 37, and 38.

¹⁷ References 7, 10, 11, 17, 22, and 25.

¹⁸ References 13-16, 20, and 21.

¹⁹ References 1, 2, 7, 10, 17, 22, 25, 29, 33-34, and 36-38.

²⁰ References 2, 5, 7, 10, 12-16, 19, and 29.

²¹ References 2, 5, and 12-15.

²² References 36-37.

²³ References 5, 10, 14-16, 18-19, 24, 26, and 46-48.

²⁴ References 3, 4, 11, 24, 30, and 40-44.

the ionization of t electrons to a continuum energy level where t and m are each an integer (e.g. K , Cs , and Sr atoms and Rb^+ ion ionize at integer multiples of the potential energy of atomic hydrogen and caused emission; whereas, the chemically similar atoms, Na , Mg , and Ba , do not ionize at integer multiples of the potential energy of atomic hydrogen and caused no emission);²⁵

(2) the observation of novel EUV emission lines from microwave and glow discharges of helium with 2% hydrogen with energies of $q \cdot 13.6 \text{ eV}$ where $q = 1, 2, 3, 4, 6, 7, 8, 9, 11, 12$ or these lines inelastically scattered by helium atoms in the excitation of $He(1s^2)$ to $He(1s^1 2p^1)$ that were identified as hydrogen transitions to electronic energy levels below the "ground" state corresponding to fractional quantum numbers;²⁶

(3) the observation of novel EUV emission lines from microwave and glow discharges of helium with 2% hydrogen at 44.2 nm and 40.5 nm with energies of $q \cdot 13.6 + \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right) X 13.6 \text{ eV}$ where $q = 2$ and $n_f = 2, 4$ $n_i = \infty$ that corresponded to multipole coupling to give two photon emission from a continuum excited state atom and an atom undergoing fractional Rydberg state transition;²⁷

(4) the identification of transitions of atomic hydrogen to lower energy levels corresponding to lower-energy hydrogen atoms in the extreme ultraviolet emission spectrum from interstellar medium and the sun;²⁸

(5) the EUV spectroscopic observation of lines by the Institut fur Niedertemperatur-Plasmaphysik e.V. that could be assigned to transitions of atomic

²⁵ References 1, 2, 7, 10, 17, 22, 25, 29, 33-34, and 36-38.

²⁶ References 13-16, and 21.

²⁷ Reference 13.

²⁸ References 20-21, 32, 45.

hydrogen to lower energy levels corresponding to fractional principal quantum numbers and the emission from the excitation of the corresponding hydride ions;²⁹

(6) the recent analysis of mobility and spectroscopy data of individual electrons in liquid helium which shows direct experimental confirmation that electrons may have fractional principal quantum energy levels;³⁰

(7) the observation of novel EUV emission lines from microwave discharges of argon or helium with 10% hydrogen that matched those predicted for vibrational transitions of $H_2^+[n=1/4; n^*=2]^+$ with energies of $\nu \cdot 1.185 \text{ eV}$, $\nu = 17 \text{ to } 38$ that terminated at the predicted dissociation limit, E_D , of $H_2[n=1/4]^+$,

$$E_D = 42.88 \text{ eV} (28.92 \text{ nm});^{31}$$

(8) the observation of continuum state emission of Cs^{2+} and Ar^{2+} at 53.3 nm and 45.6 nm , respectively, with the absence of the other corresponding Rydberg series of lines from these species which confirmed the resonant nonradiative energy transfer of 27.2 eV from atomic hydrogen to the catalysts atomic Cs or Ar^+ ; ³²

(9) the spectroscopic observation of the predicted hydride ion $H^-(1/2)$ of hydrogen catalysis by either Cs atom or Ar^+ catalyst at 407 nm corresponding to its predicted binding energy of 3.05 eV ; ³³

(10) the observation of characteristic emission from K^{3+} which confirmed the resonant nonradiative energy transfer of $3 \cdot 27.2 \text{ eV}$ from atomic hydrogen to atomic K ; ³⁴

²⁹ Reference 35.

³⁰ Reference 32.

³¹ Reference 20.

³² Reference 25.

³³ Reference 25.

³⁴ Reference 22.

(11) the spectroscopic observation of the predicted $H^-(1/4)$ ion of hydrogen catalysis by K catalyst at 110 nm corresponding to its predicted binding energy of 11.2 eV;³⁵

(12) the observation of characteristic emission from Rb^{2+} which confirmed the resonant nonradiative energy transfer of 27.2 eV from atomic hydrogen to Rb^+ ;³⁶

(13) the spectroscopic observation of the predicted $H^-(1/2)$ ion of hydrogen catalysis by Rb^+ catalyst at 407 nm corresponding to its predicted binding energy of 3.05 eV;³⁷

(14) the high-resolution visible spectroscopic observation from rt-plasmas and plasma electrolysis cells of the predicted $H^-(1/2)$ ion of hydrogen catalysis by each of K^+ / K^+ , Rb^+ , Cs , and Ar^+ at 407 nm corresponding to its predicted binding energy of 3.05 eV;³⁸

(15) the observation of $H^-(1/2)$, the hydride ion catalyst product of K^+ / K^+ or Rb^+ , by high-resolution visible spectroscopy as a broad peak at 407.00 nm with a FWHM of 0.14 nm corresponding to its predicted binding energy of 3.0468 eV;³⁹

(16) the observation that the high resolution visible plasma emission spectra in the region of 400.0 nm to 406.0 nm matched the predicted bound-free hyperfine structure lines E_{HF} of $H^-(1/2)$ calculated from the electron g factor as

$$E_{HF} = j^2 3.0056 \times 10^{-5} + 3.0575 \text{ eV} \quad (j \text{ is an integer}) \text{ for } j = 1 \text{ to } j = 37 \text{ to within a 1 part per } 10^5;^{40}$$

³⁵ References 7 and 22.

³⁶ Reference 17.

³⁷ Reference 17.

³⁸ References 2, 7, 10-11, 17, 22, and 25.

³⁹ Reference 2 and 7.

⁴⁰ References 2 and 7.

(17) Rb^+ or $2K^+$ catalysts formed a plasma having strong VUV emission with a stationary inverted Lyman population and emission from $H^-(1/2)$ was observed at 4070.0 Å corresponding to its predicted binding energy of 3.0468 eV with its predicted bound-free hyperfine structure lines $E_{HF} = j^2 3.0056 \times 10^{-5} + 3.0575 \text{ eV}$ (j is an integer) that matched for $j = 1$ to $j = 37$ to within a 1 part per 10^5 ;⁴¹

(18) the observation by the Institut für Niedertemperatur-Plasmaphysik e.V. of an anomalous plasma and plasma afterglow duration formed with hydrogen-potassium mixtures;⁴²

(19) the observation of anomalous afterglow durations of plasmas formed by catalysts providing a net enthalpy of reaction within thermal energies of $m \cdot 27.28 \text{ eV}$;⁴³

(20) the observation of Lyman series in the EUV that represents an energy release about 10 times that of hydrogen combustion which is greater than that of any possible known chemical reaction;⁴⁴

(21) the observation of line emission by the Institut für Niedertemperatur-Plasmaphysik e.V. with a 4° grazing incidence EUV spectrometer that was 100 times more energetic than the combustion of hydrogen;⁴⁵

(22) the observation of anomalous plasmas formed with Sr and Ar^+ catalysts at 1% of the theoretical or prior known voltage requirement with a light output per unit power input up to 8600 times that of the control standard light source;⁴⁶

⁴¹ Reference 2.

⁴² Reference 1, 36.

⁴³ Reference 1, 36-37.

⁴⁴ References 1, 2, 7, 10, 17, 22, 25, 29, 33-34, and 36-38.

⁴⁵ Reference 35.

⁴⁶ References 26, 29, 33, and 38.

(23) the observation that the optically measured output power of gas cells for power supplied to the glow discharge increased by over two orders of magnitude depending on the presence of less than 1% partial pressure of certain catalysts in hydrogen gas or argon-hydrogen gas mixtures, and an excess thermal balance of 42 W was measured for the 97% argon and 3% hydrogen mixture versus argon plasma alone;⁴⁷

(24) the observation that glow discharge plasmas of the catalyst-hydrogen mixtures of strontium-hydrogen, helium-hydrogen, argon-hydrogen, strontium-helium-hydrogen, and strontium-argon-hydrogen showed significant Balmer α line broadening corresponding to an average hydrogen atom temperature of 25 - 45 eV; whereas, plasmas of the noncatalyst-hydrogen mixtures of pure hydrogen, krypton-hydrogen, xenon-hydrogen, and magnesium-hydrogen showed no excessive broadening corresponding to an average hydrogen atom temperature of ≈ 3 eV;⁴⁸

(25) the observation that microwave helium-hydrogen and argon-hydrogen plasmas having catalyst Ar^+ or He^+ showed extraordinary Balmer α line broadening due to hydrogen catalysis corresponding to an average hydrogen atom temperature of 110 - 130 eV and 180 - 210 eV, respectively; whereas, plasmas of pure hydrogen, neon-hydrogen, krypton-hydrogen, and xenon-hydrogen showed no excessive broadening corresponding to an average hydrogen atom temperature of ≈ 3 eV;⁴⁹

(26) the observation that microwave helium-hydrogen and argon-hydrogen plasmas showed average electron temperatures that were high, 28,000 K and 11,600 K, respectively; whereas, the corresponding temperatures of helium and argon alone were only 6800 K and 4800 K, respectively;⁵⁰

⁴⁷ Reference 26.

⁴⁸ References 19, 29, and 33.

⁴⁹ References 12 and 13.

⁵⁰ References 12, 13 and 15.

(27) the observation of significant Balmer α line broadening of 17, 9, 11, 14, and 24 eV from rt-plasmas of incandescently heated hydrogen with K^+ / K^+ , Rb^+ , cesium, strontium, and strontium with Ar^+ catalysts, respectively, wherein the results could not be explained by Stark or thermal broadening or electric field acceleration of charged species since the measured field of the incandescent heater was extremely weak, 1 V/cm, corresponding to a broadening of much less than 1 eV;⁵¹

(28) calorimetric measurement of excess power of 20 mW/cc on rt-plasmas formed by heating hydrogen with K^+ / K^+ and Ar^+ as catalysts;⁵²

(29) the Calvet calorimetry measurement of an energy balance of over $-151,000 \text{ kJ/mole } H_2$ with the addition of 3% hydrogen to a plasma of argon having the catalyst Ar^+ compared to the enthalpy of combustion of hydrogen of $-241.8 \text{ kJ/mole } H_2$; whereas, under identical conditions no change in the Calvet voltage was observed when hydrogen was added to a plasma of noncatalyst xenon;⁵³

(30) the observation that the power output exceeded the power supplied to a hydrogen glow discharge plasmas by 35-184 W depending on the presence of catalysts from helium or argon and less than 1% partial pressure of strontium metal in noble gas-hydrogen mixtures; whereas, the chemically similar noncatalyst krypton had no effect on the power balance;⁵⁴

(31) the observation that with the addition of 3% flowing hydrogen to an argon microwave plasma with an constant input power of 40 W, the gas temperature increased from 400°C to over 750°C; whereas, the 400°C temperature of a xenon

⁵¹ Reference 10.

⁵² Reference 10.

⁵³ Reference 18.

⁵⁴ Reference 19.

plasma run under identical conditions was essentially unchanged with the addition of hydrogen;⁵⁵

(32) the observation that upon the addition of 10% hydrogen to a helium microwave plasma maintained with a constant microwave input power of 40 W , the thermal output power was measured to be at least 400 W corresponding to a reactor temperature rise from room temperature to 1200 °C within 150 seconds, a power density of 40 MW/m^3 , and an energy balance of at least $-5 \times 10^5 \text{ kJ/mole } H_2$ compared to the enthalpy of combustion of hydrogen of $-241.8 \text{ kJ/mole } H_2$;⁵⁶

(33) the differential scanning calorimetry (DSC) measurement of minimum heats of formation of KHI by the catalytic reaction of K with atomic hydrogen and KI that were over $-2000 \text{ kJ/mole } H_2$ compared to the enthalpy of combustion of hydrogen of $-241.8 \text{ kJ/mole } H_2$;⁵⁷

(34) the isolation of novel hydrogen compounds as products of the reaction of atomic hydrogen with atoms and ions which formed an anomalous plasma as reported in the EUV studies;⁵⁸

(35) the identification of a novel highly stable surface coating $SiH(1/p)$ by time of flight secondary ion mass spectroscopy that showed SiH^+ in the positive spectrum and H^- dominant in the negative spectrum and by X-ray photoelectron spectroscopy which showed that the H content of the SiH coatings was hydride ions, $H^-(1/4)$, $H^-(1/9)$, and $H^-(1/11)$ corresponding to peaks at 11, 43, and 55 eV, respectively, and showed that the surface was remarkably stable to air;⁵⁹

⁵⁵ Reference 5.

⁵⁶ Reference 13.

⁵⁷ Reference 24.

⁵⁸ References 3, 4, 11, 24, 30, and 40-44.

⁵⁹ Reference 3.

(36) the isolation of novel inorganic hydride compounds such as $KH KHCO_3$ and KH following each of the electrolysis and plasma electrolysis of a K_2CO_3 electrolyte which comprised high binding energy hydride ions that were stable in water with their identification by methods such as (i) ToF-SIMS on $KH KHCO_3$ which showed inorganic hydride clusters $K[KH KHCO_3]^+$ and a negative ToF-SIMS dominated by hydride ion, (ii) X-ray photoelectron spectroscopy which showed novel peaks corresponding to high binding energy hydride ions, and (iii) proton nuclear magnetic resonance spectroscopy which showed upfield-shifted peaks corresponding to more diamagnetic, high-binding-energy hydride ions;⁶⁰

(37) the identification of $LiHCl$ comprising a high binding energy hydride ion by time of flight secondary ion mass spectroscopy which showed a dominant H^- in the negative ion spectrum, X-ray photoelectron spectroscopy which showed $H^-(1/4)$ as a new peak at its predicted binding energy of 11 eV, 1H nuclear magnetic resonance spectroscopy which showed an extraordinary upfield-shifted peak of 15.4 ppm corresponding to the novel hydride ion, and powder X-ray diffraction which showed novel peaks;⁶¹

(38) the identification of novel hydride compounds by a number of analytic methods as such as (i) time of flight secondary ion mass spectroscopy which showed a dominant hydride ion in the negative ion spectrum, (ii) X-ray photoelectron spectroscopy which showed novel hydride peaks and significant shifts of the core levels of the primary elements bound to the novel hydride ions, (iii) 1H nuclear magnetic resonance spectroscopy (NMR) which showed extraordinary upfield chemical shifts compared to the NMR of the corresponding ordinary hydrides, and iv.) thermal decomposition with

⁶⁰ References 8, 11, 41, 43, and 44.

⁶¹ Reference 4.

analysis by gas chromatography, and mass spectroscopy which identified the compounds as hydrides;⁶²

(39) the NMR identification of novel hydride compounds MH^*X wherein M is the alkali or alkaline earth metal, X , is a halide, and H^* comprises a novel high binding energy hydride ion identified by a large distinct upfield resonance;⁶³

(40) the replication of the NMR results of the identification of novel hydride compounds by large distinct upfield resonances at Spectral Data Services, University of Massachusetts Amherst, University of Delaware, Grace Davison, and National Research Council of Canada;⁶⁴ and

(41) the NMR identification of novel hydride compounds MH^* and MH_2^* wherein M is the alkali or alkaline earth metal and H^* comprises a novel high binding energy hydride ion identified by a large distinct upfield resonance that proves the hydride ion is different from the hydride ion of the corresponding known compound of the same composition.⁶⁵

(42) the NMR, TOF-SIMS, XPS identification of novel hydrino hydride compounds and analysis of chemically-produced plasma by an expert hired by the Liebert Corporation, a division of the well-known and highly-respected Emerson Corporation. According to the expert's own words, he "observed demonstrations of the BlackLight Power (BLP) process and . . . reached the inescapable conclusion that it is based on extraordinary chemical reactions that seem to release extraordinary amounts of energy. . . . It is [his] professional opinion that the BLP process represents a chemical conversion of atomic hydrogen unlike any previously reported [in] the archival scientific literature." Although the expert states that he was skeptical of Applicant's theory, he admitted that the chemical and plasma data did support Applicant's fractional

⁶² References 8, 11, 41, and 43.

⁶³ References 4, 24, 30, 40, and 42.

⁶⁴ Reference 30.

⁶⁵ Reference 30.

quantum states and that he could offer no other explanation of the data using conventional quantum theory.⁶⁶

This significant body of experimental evidence conclusively confirms the formation of lower-energy hydrogen and, by extension, the operability and enablement of Applicant's claimed invention. Given the Secret Committee's continued failure to even consider such evidence, it stands as unrebutted and, thus, easily overcomes the Final Rejections of record under 35 U.S.C. §§ 101 and 112, first paragraph.⁶⁷

**C. The Secret Committee Has Failed to Fairly Evaluate
Applicant's Experimental Evidence Confirming
the Formation of Lower-Energy Hydrogen**

What little experimental evidence the Secret Committee does address in its Final Rejection—for the first time in most cases—does not receive even a minimum of fair consideration. Rather, the Committee continually mischaracterizes that evidence, or strains to find other unjustifiable excuses, so as to diminish its significance.

Such blatant disregard for Applicant's experimental evidence, costing tens of millions of dollars to produce, merely demonstrates a continuation of the hostility that has been directed towards Applicant since the secret examination of his applications began. Applicant nonetheless responds in good faith to the Secret Committee's unfounded criticisms as articulated in the numbered paragraphs of the Attachment that accompanied its July 20 Office Action.

⁶⁶ Reference No. 84.

⁶⁷ Applicant's prior March 12, 2001 Response to the Secret Committee's first Office Action, dated September 11, 2000, which addresses many of the same issues raised in the Committee's Final Action, is incorporated herein by reference.

1. Applicant's response to the Secret Committee's contention that "19. The Turner and Dhandapani Declarations with respect to NMR experimental data lack probative value"

Among the few items of evidence addressed by the Secret Committee are the Turner and Dhandapani Declarations submitted in support of the NMR data. The Committee argues that those Declarations lack probative value, but only by distorting the statements presented therein.

For instance, regarding Dr. Turner's Declaration, the Secret Committee focuses on a single paragraph (No. 8), noting his statement that, in his many years of conducting NMR scans, he had "never observed signals in the region of -4 to -5 ppm before." The Committee then dismisses the Declaration in its entirety based on nonsensical argument that "upfield shifts in the region from -4 to -5 ppm are known in the prior art."

The Committee must realize, however, that Dr. Turner was referring to alkali hydrides, not $\beta - Mg_2NiH_4$. Dr. Turner communicated to Applicant at the time of the initial NMR studies that metal hydrides, such as transition metal and noble metal hydrides complexes, may have upfield-shifted peaks, but no saline-like—alkali or alkaline earth metal hydrides—have been reported to have such shifts. Nor, had he observed any such shifts in these class of compounds in his twenty or so years of NMR experience.

Dr. Turner also ran the corresponding ordinary alkali and alkaline earth hydrides alone and mixed with the corresponding alkali or alkaline earth halide—no upfield peaks were observed. Only the known peaks of the alkali hydride were observed.

Regarding Dr. Dhandapani's Declaration, the Secret Committee seizes on a single word in dismissing it because it concludes "with a tentative suggestion that a 'hydrino hydride ion' may exist." Once again, the Committee's strained reasoning for refusing to seriously consider Applicant's experimental evidence merely reflects its biased approach that seeks to deny him a patent regardless of what the evidence shows.

Since no other explanation existed for the upfield-shifted NMR peaks of the alkali and alkaline earth hydrides and halido hydrides that were reproduced at five major independent laboratories, the compounds must have contained novel hydride ions. Thus, they "may" be hydrino hydrides. This is the standard conservative approach of reporting a new finding adhered to by Dr. Dhandapani.

Furthermore, the recent spectroscopic data set forth above in Section "IV.B." of this Response absolutely confirms that the novel hydride ions are hydrino hydride ions with binding energies given in Table 1 of the Specification.

The Secret Committee's further comment that the Declarants did not establish that "a host of other species, including contaminants, could not have contributed to such signals rather than the alleged 'hydrino hydride' compounds" is absurd on its face. Contaminants were considered in the assignment of the upfield-shifted peaks. NMR is only responsive to protons. The contaminants present, as identified by ToF-SIMS were trace amounts of hydroxide, other halide ions, and other alkali or alkaline earth ions. These ToF-SIMS results were provided to the Secret Committee.⁶⁸

None of the alkaline or alkaline earth hydrides produced upfield-shifted peaks alone, or in combination with, halides or hydroxide ions. The NMR peak of the latter was observed at about +4 ppm. The threshold for detection of protons by NMR is about 1% of the sample volume, an unreasonable amount based on the purity of the starting materials and the analysis of the product by ToF-SIMS and XPS. The Secret Committee has presented no prior art that the reported compounds, alkaline and alkaline earth hydrides and halido hydrides have upfield-shifted NMR peaks.

The NMR tests were replicated at Spectral Data Services, University of Massachusetts Amherst, University of Delaware, Grace Davison, and National Research Council of Canada.⁶⁹ None of these laboratories reported known alkali or alkaline earth hydrides or halido hydrides with upfield-shifted NMR peaks. The

⁶⁸ References 40 and 42.

⁶⁹ Reference 20.

assignment was confirmed by the recent NMR identification of novel hydride compounds MH^* and MH_2^* wherein M is the alkali or alkaline earth metal and H^* comprises a novel high binding energy hydride ion identified by a large distinct upfield resonance that proves the hydride ion is different from the hydride ion of the corresponding known compound of the same composition.

Furthermore, a number of recent additional tests were performed which unequivocally establish the identification of novel hydrides. The results summarized in Section "IV.B." of this Response absolutely identify the emission of the novel hydride ions, the characteristic emission from the catalysts, and the novel hydride compounds. For example:

The hydride ions formed during the catalysis reaction were identified by high-resolution spectroscopy. For example, the catalyst product of Rb^+ and two K^+ , $H(1/2)$, was predicted to be a highly reactive intermediate which further reacts to form a novel hydride ion $H^-(1/2)$. This hydride ion with a predicted binding energy of 3.0468 eV was observed by high-resolution visible spectroscopy as a broad peak at 4070.0 \AA with a FWHM of 1.4 \AA . From the electron g factor, bound-free hyperfine structure lines of $H^-(1/2)$ were predicted with energies E_{HF} given by $E_{HF} = j^2 3.0056 \times 10^{-5} + 3.0575\text{ eV}$ (j is an integer) as an inverse Rydberg-type series that converges at increasing wavelengths and terminates at 3.0575 eV —the hydride spin-pairing energy plus the binding energy. The high-resolution visible plasma emission spectra in the region of 4000 \AA to 4060 \AA matched the predicted emission lines for $j = 1$ to $j = 37$ to 1 part in 10^5 .⁷⁰

The dominant H^- in the negative ion ToF-SIMS spectra confirm the novel compositions of matter.⁷¹

⁷⁰ References 2 and 7.

⁷¹ References 3, 4, 40, 42, and 43.

The core level shifts of the alkali or alkaline earth metal due to the binding of the hydrino hydride ion confirm the new alkali and alkaline earth hydrides and halido hydrides.⁷²

The hydrino hydride binding energies observed by XPS confirm the claimed compositions of matter.⁷³

The novel peaks observed by liquid chromatography/mass spectroscopy confirm the new compound *KHI*.⁷⁴

Large heats of formation confirm the new compound *KHI*.⁷⁵

Unable to offer its own rational explanation for Applicant's astounding NMR data and other submitted evidence, the Secret Committee resorts to distortions and other obfuscations to reject the obvious conclusion that must be drawn from that evidence—that fractional quantum states of hydrogen do indeed exist.

2. Applicant's response to the Secret Committee's contention that "24. Applicant's spectroscopic and plasma experimental data are not persuasive"

The Secret Committee's unfounded criticism of Applicant's experimental evidence continues with its dismissal of Applicant's spectroscopic and plasma data as being unpersuasive. And, once again, Applicant dismantles those criticisms in exposing the Committee's weak position.

As an initial matter, Applicant notes that the skepticism on the part of STC experts regarded whether a 55 eV peak observed in the low binding energy region of the XPS spectrum of the high purity nickel cathode was a predicted hydrino peak or

⁷² References 40 and 42.

⁷³ References 3, 4, 40, 41, 42, and 43.

⁷⁴ Reference 40.

⁷⁵ Reference 24.

whether the peak was due to iron. The survey scan, which was not given to the STC experts until a later date, showed no iron peaks. It was later confirmed by ToF-SIMS that iron could not be the source of the novel peak observed.⁷⁶

The Secret Committee is mistaken as to what is identified in figure 17, for example. The identified hydride ion $H^-(1/p)$ peaks correspond to their predicted binding energies, which are given in Table 1 of the Application. They do not correspond to transitions between different orbitals or energy levels.

Furthermore, the peaks should have low intensity since the cross-section for the ionizing X-rays is proportional to the radius of the atom squared, and the radius of the hydrino hydride ions are much smaller than the radii of the other elements present such as potassium. Extensive data which confirm hydrino hydride ions by XPS is summarized in Section "IV.B." of this Response.

On page 3, line 31 through page 4, line 5 of the present specification, Applicant discloses:

This invention is directed to a new composition of matter comprising a hydride ion (H^-) having a binding energy greater than 0.8 eV , as reflected in the following formula

$$\text{Binding Energy} = \frac{\hbar^2 \sqrt{s(s+1)}}{8\mu_e a_0^2 \left[\frac{1 + \sqrt{s(s+1)}}{p} \right]^2} - \frac{\pi \mu_0 e^2 \hbar^2}{m_e^2 a_0^3} \left(1 + \frac{2^2}{\left[\frac{1 + \sqrt{s(s+1)}}{p} \right]^3} \right) \quad (1)$$

where p is an integer greater than one, $s = 1/2$, π is pi, \hbar is Planck's constant bar, μ_0 is the permeability of vacuum, m_e is the mass of the electron, μ_e is the reduced electron mass, a_0 is the Bohr radius, and e is the elementary charge.

From page 6, lines 1-25 of the present specification, Applicant discloses:

⁷⁶ Reference 82.

TABLE 1. The representative binding energy of the hydrino hydride ion $H^-(n = 1/p)$ as a function of p , Eq. (1).

Hydride Ion	r_1 (a_0) ^a	Binding Energy ^b (eV)	Wavelength (nm)
$H^-(n = 1/2)$	0.9330	3.047	407
$H^-(n = 1/3)$	0.6220	6.610	188
$H^-(n = 1/4)$	0.4665	11.23	110
$H^-(n = 1/5)$	0.3732	16.70	74.2
$H^-(n = 1/6)$	0.3110	22.81	54.4
$H^-(n = 1/7)$	0.2666	29.34	42.3
$H^-(n = 1/8)$	0.2333	36.08	34.4
$H^-(n = 1/9)$	0.2073	42.83	28.9
$H^-(n = 1/10)$	0.1866	49.37	25.1
$H^-(n = 1/11)$	0.1696	55.49	22.3
$H^-(n = 1/12)$	0.1555	60.97	20.3
$H^-(n = 1/13)$	0.1435	65.62	18.9
$H^-(n = 1/14)$	0.1333	69.21	17.9
$H^-(n = 1/15)$	0.1244	71.53	17.3
$H^-(n = 1/16)$	0.1166	72.38	17.1

^a Equation (21), *infra*.

^b Equation (22), *infra*.

These hydride ions are now identified definitively by recent XPS data and additional methods such as high-resolution visible spectroscopy as summarized in Section "IV.B." of this Response.

For example, the catalyst product of Rb^+ and two K^+ , $H(1/2)$, was predicted to be a highly reactive intermediate which further reacts to form a novel hydride ion $H^-(1/2)$. This hydride ion with a predicted binding energy of 3.0468 eV was observed by high-resolution visible spectroscopy as a broad peak at 4070.0 Å with a FWHM of 1.4 Å. From the electron g factor, bound-free hyperfine structure lines of $H^-(1/2)$ were predicted with energies E_{HF} given by $E_{HF} = j^2 3.0056 \times 10^{-5} + 3.0575 \text{ eV}$ (j is an integer) as an inverse Rydberg-type

series that converges at increasing wavelengths and terminates at 3.0575 eV — the hydride spin-pairing energy plus the binding energy. The high-resolution visible plasma emission spectra in the region of 4000 Å to 4060 Å matched the predicted emission lines for $j = 1$ to $j = 37$ to 1 part in 10^5 .⁷⁷

The Secret Committee's position that Applicant's plasma, which forms at 2 V, cannot be due to energy tapped off from lower-energy hydrogen formation is based on the false premise that Applicant has not shown lower-energy hydrogen production. Applicant, however, has in fact demonstrated that electrons with fractional quantum numbers do exist.⁷⁸

Studies that experimentally confirm the disclosed novel reaction of atomic hydrogen, which produces hydrogen in fractional quantum states that are at lower energies than the traditional "ground" ($n = 1$) state, a chemically generated or assisted plasma (rt-plasma), and novel hydride compounds are described in detail in Section "IV.B." of this Response. A brief summary includes:

- extreme ultraviolet (EUV) spectroscopy,
- characteristic emission from catalysis and the hydride ion products,
- lower-energy hydrogen emission,
- plasma formation,
- Balmer α line broadening,
- elevated electron temperature,
- anomalous plasma afterglow duration,
- power generation, and
- analysis of chemical compounds.

⁷⁷ References 2 and 7.

⁷⁸ Reference 32.

To assist the Secret Committee in understanding the novel catalytic reaction of atomic hydrogen of the present invention, an excerpt from R. L. Mills, P. Ray, "High Resolution Spectroscopic Observation of the Bound-Free Hyperfine Levels of a Novel Hydride Ion Corresponding to a Fractional Rydberg State of Atomic Hydrogen", *Int. J. Hydrogen Energy*, in press, is provided:

I. INTRODUCTION

A. Background

J. J. Balmer showed in 1885 that the frequencies for some of the lines observed in the emission spectrum of atomic hydrogen could be expressed with a completely empirical relationship. This approach was later extended by J. R. Rydberg, who showed that all of the spectral lines of atomic hydrogen were given by the equation:

$$\bar{\nu} = R \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right) \quad (1)$$

where $R = 109,677 \text{ cm}^{-1}$, $n_f = 1, 2, 3, \dots$, $n_i = 2, 3, 4, \dots$, and $n_i > n_f$.

Niels Bohr, in 1913, developed a theory for atomic hydrogen that gave the energy levels in agreement with Rydberg's equation. An identical equation, based on a totally different theory for the hydrogen atom, was developed by E. Schrodinger, and independently by W. Heisenberg, in 1926.

$$E_n = -\frac{e^2}{n^2 8\pi\epsilon_0 a_H} = -\frac{13.598 \text{ eV}}{n^2} \quad (2a)$$

$$n = 1, 2, 3, \dots \quad (2b)$$

where a_H is the Bohr radius for the hydrogen atom (52.947 pm), e is the magnitude of the charge of the electron, and ϵ_0 is the vacuum permittivity.

The excited energy states of atomic hydrogen are given by Eq. (2a) for $n > 1$ in Eq. (2b). The $n = 1$ state is the "ground" state for "pure" photon transitions (the $n = 1$ state can absorb a photon and go to an excited electronic state, but it cannot release a photon and go to a lower-energy

electronic state). However, an electron transition from the ground state to a lower-energy state may be possible by a nonradiative energy transfer such as multipole coupling or a resonant collision mechanism. Processes such as hydrogen molecular bond formation that occur without photons and that require collisions are common [1]. Also, some commercial phosphors are based on resonant nonradiative energy transfer involving multipole coupling [2].

We propose that atomic hydrogen may undergo a catalytic reaction with certain atomized elements and ions which singly or multiply ionize at integer multiples of the potential energy of atomic hydrogen, $m \cdot 27.2 \text{ eV}$ wherein m is an integer. The theory and supporting data was given previously [3-37]. The reaction involves a nonradiative energy transfer to form a hydrogen atom that is lower in energy than unreacted atomic hydrogen called a *hydrino* that corresponds to a fractional principal quantum number. That is

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}; \quad p \text{ is an integer} \quad (2c)$$

replaces the well-known parameter $n = \text{integer}$ in the Rydberg equation for hydrogen excited states. The $n = 1$ state of hydrogen and the $n = \frac{1}{\text{integer}}$

states of hydrogen are nonradiative, but a transition between two nonradiative states is possible via a nonradiative energy transfer, say $n = 1$ to $n = 1/2$. In these cases, during the transition the electron couples to another electron transition, electron transfer reaction, or inelastic scattering reaction which can absorb the exact amount of energy that must be removed from the hydrogen atom to cause the transition. Thus, a catalyst provides a net positive enthalpy of reaction of $m \cdot 27.2 \text{ eV}$ (i.e., it absorbs $m \cdot 27.2 \text{ eV}$ where m is an integer). Certain atoms or ions serve as catalysts which resonantly accept the nonradiative energy transfer from hydrogen atoms and release the energy to the surroundings to affect electronic transitions to fractional quantum energy levels. As a consequence of the nonradiative energy transfer, the hydrogen atom becomes unstable and emits further energy until it achieves a lower-energy nonradiative state having a principal energy level given by Eqs. (2a) and (2c).

B. rt-plasma

It was reported previously that a new plasma source has been developed that operates by incandescently heating a hydrogen dissociator to provide atomic hydrogen and heats a catalyst such that it becomes

gaseous and reacts with the atomic hydrogen to produce a rt-plasma. It was extraordinary, that intense EUV emission was observed by Mills et al. [11, 13-15, 23-24, 26-27] at low temperatures (e.g. $\approx 10^3 \text{ K}$) from atomic hydrogen and certain atomized elements or certain gaseous ions which singly or multiply ionize at integer multiples of the potential energy of atomic hydrogen, 27.2 eV that comprise catalysts. The only pure elements that were observed to emit EUV were those wherein the ionization of t electrons from an atom to a continuum energy level is such that the sum of the ionization energies of the t electrons is approximately

$$m \cdot 27.2 \text{ eV} \tag{3}$$

where t and m are each an integer. Alternatively, a catalyst depended on the transfer of t electrons between participating ions such that the transfer of t electrons from one ion to another ion provides a net enthalpy of reaction whereby the sum of the ionization energy of the electron donating ion minus the ionization energy of the electron accepting ion equals approximately $m \cdot 27.2 \text{ eV}$.

Since Ar^+ and strontium each ionize at an integer multiple of the potential energy of atomic hydrogen, a discharge with one or more of these species present with hydrogen was anticipated to form a rt-plasma wherein the plasma forms by a resonance transfer mechanism involving the species providing a net enthalpy of a multiple of 27.2 eV and atomic hydrogen.

Mills and Nansteel [11, 16-17, 23] have reported that strontium atoms each ionize at an integer multiple of the potential energy of atomic hydrogen and caused emission. (The enthalpy of ionization of Sr to Sr^{5+} has a net enthalpy of reaction of 188.2 eV , which is equivalent to $m = 7$.) The emission intensity of the plasma generated by atomic strontium increased significantly with the introduction of argon gas only when Ar^+ emission was observed. Whereas, no emission was observed when chemically similar atoms that do not ionize at integer multiples of the potential energy of atomic hydrogen (sodium, magnesium, or barium) replaced strontium with hydrogen, hydrogen-argon mixtures, or strontium alone.

Mills and Nansteel [16-17, 23] measured the power balance of a gas cell having vaporized strontium and atomized hydrogen from pure hydrogen or argon-hydrogen mixture (77/23%) by integrating the total light output corrected for spectrometer system response and energy over the visible range. Hydrogen control cell experiments were identical except that sodium, magnesium, or barium replaced strontium. In the case of

hydrogen-sodium, hydrogen-magnesium, and hydrogen-barium mixtures, 4000, 7000, and 6500 times the power of the hydrogen-strontium mixture was required, respectively, in order to achieve that same optically measured light output power. With the addition of argon to the hydrogen-strontium plasma, the power required to achieve that same optically measured light output power was reduced by a factor of about two. The power required to maintain a plasma of equivalent optical brightness with strontium atoms present was 8600 and 6300 times less than that required for argon-hydrogen and argon control, respectively. A plasma formed at a cell voltage of about 250 V for hydrogen alone and sodium-hydrogen mixtures, 140-150 V for hydrogen-magnesium and hydrogen-barium mixtures, 224 V for an argon-hydrogen mixture, and 190 V for argon alone; whereas, a plasma formed for hydrogen-strontium mixtures and argon-hydrogen-strontium mixtures at extremely low voltages of about 2 V and 6.6 V, respectively.

It was reported [15] that characteristic emission was observed from a continuum state of Ar^{2+} which confirmed the resonant nonradiative energy transfer of 27.2 eV from atomic hydrogen Ar^+ . The transfer of 27.2 eV from atomic hydrogen to Ar^+ in the presence of a electric weak field resulted in its excitation to a continuum state. Then, the energy for the transition from essentially the Ar^{2+} state to the lowest state of Ar^+ was predicted to give a broad continuum radiation in the region of 456 \AA . This broad continuum emission was observed. This emission was dramatically different from that given by an argon microwave plasma wherein the entire Rydberg series of lines of Ar^+ was observed with a discontinuity of the series at the limit of the ionization energy of Ar^+ to Ar^{2+} . The observed Ar^+ continuum in the region of 456 \AA confirmed the rt-plasma mechanism of the excessively bright, extraordinarily low voltage discharge. The product hydride ion with Ar^+ as a reactant was predicted to have a binding energy of 3.05 eV and was observed spectroscopically at 4070 \AA [11, 15].

The catalysts mechanism has been confirmed spectroscopically for helium ion, rubidium ion, potassium atom and two potassium ions, argon ion, and cesium atom by the observation of the formation of the predicted oxidation states of the catalyst, which cannot be ordinarily explained under the operating conditions of the cell, by characteristic emission from the catalysts, and by spectroscopic identification of lower-energy atomic, molecular ion, or hydride ions as summarized in Section "IV.B." of this Response.

Strontium may serve as a catalyst since it can provide a net enthalpy of reaction of an integer multiple of that the potential energy of atomic hydrogen. The first through the fifth ionization energies of strontium are 5.69484 eV, 11.03013 eV, 42.89 eV, 57 eV, and 71.6 eV, respectively.⁷⁹ The ionization reaction of Sr to Sr⁵⁺, (t = 5), then, has a net enthalpy of reaction of 188.2 eV, which is equivalent to 7 · 27.2 eV with in experimental error of the published ionization energies for strontium.

$$188.2 \text{ eV} + \text{Sr}(m) + H\left[\frac{a_H}{p}\right] \rightarrow \text{Sr}^{5+} + 5e^- + H\left[\frac{a_H}{(p+7)}\right] + [(p+7)^2 - p^2]X13.6 \text{ eV} \quad (6)$$

$$\text{Sr}^{5+} + 5e^- \rightarrow \text{Sr}(m) + 188.2 \text{ eV} \quad (7)$$

And, the overall reaction is

$$H\left[\frac{a_H}{p}\right] \rightarrow H\left[\frac{a_H}{(p+7)}\right] + [(p+7)^2 - p^2]X13.6 \text{ eV} \quad (8)$$

The oxidation state in which strontium is commonly found in inorganic compounds is irrelevant to the present catalytic reaction since it only involves a resonance between atomic hydrogen and strontium without any regard to the formation of stable inorganic compounds such as strontium chloride.

The identification of Sr⁵⁺ is experimentally challenging due to required detection at very short wavelengths. The formation of a hydrogen plasma with atomic hydrogen and atomic strontium with no plasma from controls such as magnesium supports that Sr is acting as a catalyst since no conventional explanation of the data can be found. The Secret Committee provides no prior art for the formation of a hydrogen plasma by heating strontium with atomic hydrogen or for the formation of a discharge at 2 V with strontium and hydrogen present.

The Secret Committee further criticizes the experiments conducted at the Institut fur Niedertemperatur-Plasmaphysik e.V. by Dr. Conrads "with funding apparently provided by applicant's company, BlackLight Power Inc." Such criticism is completely off base. While true that the independent work performed at Institut fur

⁷⁹ Reference 85.

Niedertemperatur-Plasmaphysik e.V. was supported by Applicant, it is ludicrous to suggest that the Director and Chairman of the Board of one Germany's most prestigious National Laboratories, once headed by two Noble Laureates Stark and Mie, would in any way compromise his scientific integrity.

Such unfounded criticisms stand in stark contrast to Applicant's overwhelming experimental test results that are the basis for over 50 submitted scientific papers, 34 of which have been peer-reviewed and either published or accepted for publication in highly-respected scientific journals, and an extensive book.⁸⁰ It is standard practice for those holding to rigorous scientific due process to submit their results for peer review. Publication confers that the methods are scientifically sound in the view of the referees.

In Applicant's last interview with the PTO, Secret Committee Member Jagannathan required that Applicant's technology be published in peer-reviewed journals before he would allow a patent to issue. While patentability standards do not recognize any such requirement, Applicant has clearly met this newly-imposed burden in light of the 34 papers that have been published or accepted for publication in such journals.

The comprehensive scientific results overwhelmingly demonstrate the operability and enablement of Applicant's disclosed invention. The Secret Committee now has the obligation to fairly analyze Applicant's experimental data, which dictates allowance of the pending claims.

3. Applicant's response to the Secret Committee's contention that "25. The Mills Declaration with respect to 'extreme ultraviolet spectroscopic data' lacks probative value"

Applicant has demonstrated that his disclosed catalyst mechanism is not only plausible, but is, in fact, operable. Based on comments by the Secret Committee, it clearly fails to understand how that mechanism works.

⁸⁰ The experimental test results are the basis of the 50 journal articles, 3 correspondences, and book listed and described in the Section "IV.B." of this Response.

For instance, contrary to the Committee's mistaken belief, Applicant is not trying "to force a match between the input and output of energy." A resonance exists between He^+ and atomic hydrogen. That is why helium ion is selected as a catalyst. The same applies for the case of strontium. Only certain ions and atoms provide a reaction that has a net enthalpy of an integer multiple of the potential energy of atomic hydrogen.

For example, the first, second, and third ionization energies of potassium are 4.34066 eV , 31.63 eV , and 45.806 eV , respectively. The triple ionization ($i = 3$) reaction of K to K^{3+} , then, has a net enthalpy of reaction of 81.7766 eV , which is equivalent to $3 \cdot 27.2\text{ eV}$. Potassium is readily available from chemical supply companies such as Alpha Aesar. This is heated to form gaseous potassium atoms in the cell. The potassium atoms react with atomic hydrogen produced by dissociation at a hot filament for example. A hydrogen atom transfers 81.6 eV to a potassium atom which is ionized to K^{3+} due to the RESONANT NONRADIATIVE ENERGY TRANSFER. The K^{3+} ion is unequivocally observed spectroscopically.⁸¹

The Secret Committee has offered no art or explanation for the formation of K^{3+} at $700\text{ }^\circ\text{C}$. Lower-energy hydrogen is formed as indicated by the formation of a plasma due to the energy release, and a novel hydride ion is formed with a binding energy of 11 eV corresponding to the observed emission at 110 nm .⁸² Novel hydride compounds are formed.⁸³ A large enthalpy of formation of the hydrides is observed.⁸⁴ No energy match is forced, as misunderstood by the Secret Committee.

To better educate the Secret Committee about Applicant's catalytic reaction, the following excerpt from R. L. Mills, P. Ray, B. Dhandapani, M. Nansteel, X. Chen, J. He, "New Power Source from Fractional Rydberg States of Atomic Hydrogen", Chem. Phys. Letts., submitted, is provided:

⁸¹ Reference 22.

⁸² References 7 and 22.

⁸³ References 20, 40, and 42.

⁸⁴ Reference 24.

1. Introduction

J. R. Rydberg showed that all of the spectral lines of atomic hydrogen were given by a completely empirical relationship:

$$\bar{\nu} = R \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right) \quad (1)$$

where $R = 109,677 \text{ cm}^{-1}$, $n_f = 1, 2, 3, \dots$, $n_i = 2, 3, 4, \dots$ and $n_i > n_f$. Bohr, Schrodinger, and Heisenberg each developed a theory for atomic hydrogen that gave the energy levels in agreement with Rydberg's equation.

$$E_n = -\frac{e^2}{n^2 8\pi\epsilon_0 a_H} = -\frac{13.598 \text{ eV}}{n^2} \quad (2a)$$

$$n = 1, 2, 3, \dots \quad (2b)$$

The excited energy states of atomic hydrogen are given by Eq. (2a) for $n > 1$ in Eq. (2b). The $n = 1$ state is the "ground" state for "pure" photon transitions (*i.e.*, the $n = 1$ state can absorb a photon and go to an excited electronic state, but it cannot release a photon and go to a lower-energy electronic state). However, an electron transition from the ground state to a lower-energy state may be possible by a resonant nonradiative energy transfer such as multipole coupling or a resonant collision mechanism. Processes such as hydrogen molecular bond formation that occur without photons and that require collisions are common [1]. Also, some commercial phosphors are based on resonant nonradiative energy transfer involving multipole coupling [2].

We propose that atomic hydrogen may undergo a catalytic reaction with certain atoms and ions such as He^+ which singly or multiply ionize at integer multiples of the potential energy of atomic hydrogen, $m \cdot 27.2 \text{ eV}$ wherein m is an integer. The theory was given previously [3-5]. The reaction involves a nonradiative energy transfer to form a hydrogen atom that is lower in energy than unreacted atomic hydrogen that corresponds to a fractional principal quantum number. That is

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}; \quad p \text{ is an integer} \quad (2c)$$

replaces the well-known parameter $n = \text{integer}$ in the Rydberg equation for hydrogen excited states. The $n = 1$ state of hydrogen and the $n = \frac{1}{\text{integer}}$ states of hydrogen are nonradiative, but a transition between two nonradiative states is possible via a nonradiative energy transfer, say $n = 1$ to $n = 1/2$. Thus, a catalyst provides a net positive enthalpy of reaction of $m \cdot 27.2 \text{ eV}$ (*i.e.*, it resonantly accepts the nonradiative energy transfer from hydrogen atoms and releases the energy to the surroundings to affect electronic transitions to fractional quantum energy levels). As a consequence of the nonradiative energy transfer, the hydrogen atom becomes unstable and emits further energy until it achieves a lower-energy nonradiative state having a principal energy level given by Eqs. (2a) and (2c).

A. EUV Spectroscopy

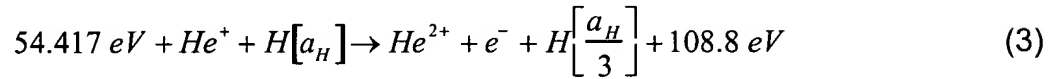
In the case of the EUV spectrum of hydrogen, xenon, or xenon-hydrogen (98/2%), no peaks were observed below 78 nm , and no spurious peaks or artifacts due to the grating or the spectrometer were observed. Only known He I and He II peaks were observed in the EUV spectrum of the control helium microwave discharge cell emission.

The EUV spectra ($17.5 - 50 \text{ nm}$) of the microwave cell emission of the helium-hydrogen mixture (98/2%) (top curve) and the helium control (bottom curve) are shown in Figure 1. Ordinary hydrogen has no emission in these regions. Novel peaks were observed at 45.6 nm , 37.4 nm , and 20.5 nm which do not correspond to helium. At the 1 Torr condition, additional novel peaks were observed in the short wavelength region ($5 - 65 \text{ nm}$) at 14.15 nm , 13.03 nm , 10.13 nm , and 8.29 nm which do not correspond to helium as shown in Figure 1. Known He I lines which were used for calibration of the novel peak positions were observed at 58.4 nm , 53.7 nm , and 52.4 nm . It is proposed that the 30.4 nm peak shown in Figures 1 and 2 was not entirely due to the He II transition. In the case of the helium-hydrogen mixture, the ratio of 30.4 nm (40.8 eV) peak to the 25.6 nm (48.3 eV) was 10 compared to 5.4 for helium alone as shown in Figure 1 which implies only a minor He II transition contribution to the 30.4 nm peak.

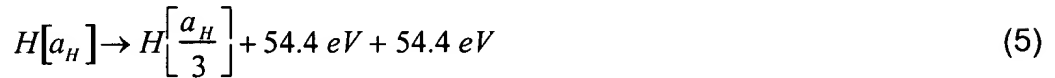
It is proposed that the majority of the 91.2 nm peak was also due to a novel transition. At 20 Torr, the ratio of the Lyman β peak to the 91.2 nm peak of the helium-hydrogen plasma was 2 compared to 8 for each control hydrogen and xenon-hydrogen plasma which indicates that

the majority of the 91.2 nm peak was due to a transition other than the binding of an electron by a proton.

The novel peaks fit two empirical relationships. In order of energy, the set comprising the peaks at 91.2 nm, 45.6 nm, 30.4 nm, 13.03 nm, 10.13 nm, and 8.29 nm correspond to energies of $q \cdot 13.6 \text{ eV}$ where $q = 1, 2, 3, 7, 9, 11$. In order of energy, the set comprising the peaks at 37.4 nm, 20.5 nm, and 14.15 nm correspond to energies of $q \cdot 13.6 - 21.21 \text{ eV}$ where $q = 4, 6, 8$. These lines can be explained as electronic transitions to fractional Rydberg states of atomic hydrogen given by Eqs. (2a) and (2c) wherein the catalytic system involves helium ions because the second ionization energy of helium is 54.417 eV , which is equivalent to $2 \cdot 27.2 \text{ eV}$. In this case, 54.417 eV is transferred nonradiatively from atomic hydrogen to He^+ which is resonantly ionized. The electron decays to the $n = 1/3$ state with the further release of 54.417 eV which may be emitted as a photon. The catalysis reaction is

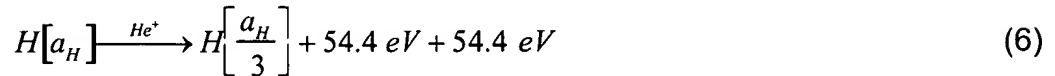


And, the overall reaction is



Since the products of the catalysis reaction have binding energies of $m \cdot 27.2 \text{ eV}$, they may further serve as catalysts. Thus, further catalytic transitions may occur: $n = \frac{1}{3} \rightarrow \frac{1}{4}$, $\frac{1}{4} \rightarrow \frac{1}{5}$, and so on.

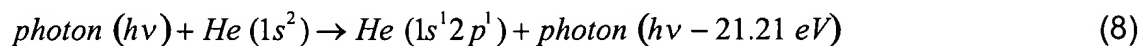
Electronic transitions to Rydberg states given by Eqs. (2a) and (2c) catalyzed by the resonant nonradiative transfer of $m \cdot 27.2 \text{ eV}$ would give rise to a series of emission lines of energies $q \cdot 13.6 \text{ eV}$ where q is an integer. It is further proposed that the photons that arise from hydrogen transitions may undergo inelastic helium scattering. That is, the catalytic reaction



yields 54.4 eV by Eq. (4) and a photon of 54.4 eV (22.8 nm). Once emitted, the photon may be absorbed or scattered. When this photon strikes $\text{He}(1s^2)$, 21.2 eV may be absorbed in the excitation to $\text{He}(1s^1 2p^1)$. This leaves a 33.19 eV (37.4 nm) photon peak and a 21.2 eV (58.4 nm) photon from $\text{He}(1s^1 2p^1)$. Thus, for helium the inelastic scattered peak of 54.4 eV photons from Eq. (3) is given by

$$E = 54.4 \text{ eV} - 21.21 \text{ eV} = 33.19 \text{ eV} (37.4 \text{ nm}) \quad (7)$$

A novel peak shown in Figures 1 and 2 was observed at 37.4 nm . Furthermore, the intensity of the 58.4 nm peak corresponding to the spectra shown in Figure 2 was about 60,000 photons/sec. Thus, the transition $\text{He}(1s^2) \rightarrow \text{He}(1s^1 2p^1)$ dominated the inelastic scattering of EUV peaks. The general reaction is



The two empirical series may be combined—one directly from Eqs. (2a, 2c) and the other indirectly with Eq. (8). The energies for the novel lines in order of energy are 13.6 eV , 27.2 eV , 40.8 eV , 54.4 eV , 81.6 eV , 95.2 eV , 108.8 eV , 122.4 eV and 149.6 eV . The corresponding peaks are 91.2 nm , 45.6 nm , 30.4 nm , 37.4 nm , 20.5 nm , 13.03 nm , 14.15 nm , 10.13 nm , and 8.29 nm , respectively. Thus, the identified novel lines correspond to energies of $q \cdot 13.6 \text{ eV}$ where $q = 1, 2, 3, 4, 6, 7, 8, 9, 11$ or these lines inelastically scattered by helium atoms wherein 21.2 eV was absorbed in the excitation of $\text{He}(1s^2)$ to $\text{He}(1s^1 2p^1)$. The values of q observed are consistent with those expected based on Eq. (5) and the subsequent autocatalyzed reactions as discussed previously [6]. The satellite peak at 44.2 nm shown in Figure 1 and 2 may be due to multipole coupling as discussed elsewhere [12]. There is remarkable agreement between the data and the proposed transitions to fractional Rydberg states and these lines inelastically scattered by helium according to Eq. (8). All other peaks could be assigned to He I, He II, second order lines, or atomic or molecular hydrogen emission. No known lines of helium or hydrogen explain the $q \cdot 13.6 \text{ eV}$ related set of peaks.

The Secret Committee's refusal to consider Applicant's data of lower-energy hydrogen transitions is based on the false premise that it violates quantum theory.

Applicant's theory, however, does not violate physical laws, such as Maxwell's equation, with which the Secret Committee's cited theory conflicts.⁸⁵

THEORY MUST CONFORM TO DATA, RATHER THAN DATA CONFORM TO THEORY AS ESPOUSED BY THE SECRET COMMITTEE. THE COMMITTEE HAS SHOWN A CLEAR BIAS IN ITS DEFENSE OF QUANTUM MECHANICS, BUT IT CANNOT MAKE APPLICANT'S DATA GO AWAY JUST BECAUSE IT WISHES IT SO. APPLICANT HAS MET THE BURDEN OF SHOWING THE SPECTRAL LINES DEMANDED BY THE SECRET COMMITTEE. THE SECRET COMMITTEE HAS OFFERED NO OTHER EXPLANATION OF THESE LINES. APPLICANT HAS A RIGHT TO HAVE HIS APPLICATION FAIRLY EVALUATED—NOT DISMISSED OUT OF HAND.

The stability of the hydrino states is given in Section 7 of the Appendix attached to this Response. The excited state lines of hydrogen are shown in Applicant's publications.⁸⁶ The hydrino transitions are also observed when a catalyst (in this case) is provided.⁸⁷ In the case of the spectrum of Bethe and Salpeter, no catalyst was present. Thus, no hydrino lines are predicted by Applicant and none were observed in agreement with Applicant's theory. As pointed out in other sections of the Appendix attached to this Response, such as Section 17, standard quantum mechanics cannot possibly be the absolute representation of the hydrogen atom from which absolute conclusions about the existence or nonexistence of hydrinos can be drawn.

The Secret Committee has it exactly backwards. Applicant's spectral lines disprove quantum mechanics. Applicant's theory is based on Maxwell's equations, which is a physical law. [See Sections 1, 2, 3, 7, 14, and 17 of the Appendix to this Response] The Committee relies on a fatally flawed, internally inconsistent, probability wave theory as the sole basis to reject the present invention.

⁸⁵ The fallacies of the Secret Committee's theoretical argument are pointed out in the Appendix attached to this Response. [See, in particular, Sections 3, 9, and 17]

⁸⁶ Reference 21.

⁸⁷ Reference 21.

The Secret Committee is further misguided and incorrect in its assessment that "Hence, standard quantum mechanics is a thousand times more accurate in its predictive power, for the spectral lines of the hydrogen atom, compared to applicant's improper theory." Only Applicant's theory is derived from first principles and holds over a scale of spacetime of 85 orders of magnitude—it correctly predicts the nature of the universe from the scale of the quarks to that of the cosmos. Quantum mechanics and the Heisenberg Uncertainty Principle are not laws of nature. They are based on circular arguments that the electron is a probability wave requiring that the electron have multiple positions and energies including negative and infinite energies simultaneously. Both are postulated, cannot be proven experimentally, and predict consequences such as violation of conservation of energy and momentum and an essentially infinite cosmological constant. These predictions are not in agreement with experimentation.

Furthermore, it was recently proven experimentally that the Heisenberg Uncertainty principle has nothing to do with wave-particle duality;⁸⁸ whereas, the opposite is largely touted as one of its triumphs. In contrast, the observable features of atomic particles such as the electron g factor may be calculated in closed form from Maxwell's equations with 11-figure accuracy without invoking the vagaries and inconsistencies inherent with the Heisenberg Uncertainty Principle.⁸⁹ And, Applicant predicts fractional quantum states as "allowed" in the Rydberg energy equation, which states are demonstrated experimentally. The Secret Committee has offered no explanation for the data summarized in Section "IV.B." of this Response. The Committee cannot simply dismiss that data out of hand so as to avoid dealing with the conclusions to be drawn from it.

Both of the papers discussed in the Mills Declaration and mentioned by the Committee have gone through extensive peer review and thus are even more compelling. They are scheduled to appear as new journal articles:

⁸⁸ References 32 and 45.

⁸⁹ Reference 39.

R. Mills, P. Ray, "Spectroscopic Identification of a Novel Catalytic Reaction of Potassium and Atomic Hydrogen and the Hydride Ion Product", Int. J. Hydrogen Energy, Vol. 27, No. 2, February, (2002), pp. 183-192.

R. Mills, P. Ray, "Spectral Emission of Fractional Quantum Energy Levels of Atomic Hydrogen from a Helium-Hydrogen Plasma and the Implications for Dark Matter", Int. J. Hydrogen Energy, Vol. 27, No. 3, (2002), pp. 301-322.

In addition, Applicant has obtained overwhelming spectroscopic data of the existence of lower-energy hydrogen, which matches theoretical predictions remarkably well. For example, on page 4, lines 8-12 of the present specification, Applicant discloses:

The hydride ion of the present invention is formed by the reaction of an electron with a hydrogen atom having a binding energy given by

$$\text{Binding Energy} = \frac{13.6 \text{ eV}}{n^2} \quad (2)$$

where $n = \frac{1}{p}$ and p is an integer greater than one.

From R. L. Mills, P. Ray, B. Dhandapani, J. He, "Spectroscopic Identification of Fractional Rydberg States of Atomic Hydrogen", J. of Phys. Chem. (letter), submitted:

Extreme ultraviolet (EUV) spectroscopy was recorded on microwave discharges of helium with 2% hydrogen. Novel emission lines were observed with energies of $q \cdot 13.6 \text{ eV}$ where $q = 1, 2, 3, 4, 6, 7, 8, 9, 11, 12$ or these lines inelastically scattered by helium atoms wherein 21.2 eV was absorbed in the excitation of $\text{He}(1s^2)$ to $\text{He}(1s^1 2p^1)$. These lines can be explained as fractional Rydberg states of atomic hydrogen. Novel emission lines were also observed at 44.2 nm and 40.5 nm with energies of $q \cdot 13.6 + \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right) \cdot 13.6 \text{ eV}$ where $q = 2$ and $n_f = 2, 4$ $n_i = \infty$ that corresponded to multipole coupling to give two photon emission from a

continuum excited state atom and an atom undergoing a fractional Rydberg state transition. Such transitions would be extremely energetic; so, the width of the 656.2 nm Balmer α line emitted from the plasmas was measured, and the electron temperature T_e was measured from the ratio of the intensity of the He 501.6 nm line to that of the He 492.2 line. Significant line broadening corresponding to an average hydrogen atom temperature of 180 - 210 eV was observed for helium-hydrogen microwave plasmas; whereas, pure hydrogen showed no excessive broadening corresponding to an average hydrogen atom temperature of ≈ 3 eV. Similarly, the average electron temperature for helium-hydrogen plasma was 28,000 K; whereas, the corresponding temperature of helium alone was only 6800 K.

THE SECRET COMMITTEE OFFERS NO EXPLANATION FOR THIS DATA OF LOWER-ENERGY ATOMIC HYDROGEN EMISSION—BUT RATHER, MERELY DISMISSES IT BASED ON A FLAWED THEORY.

From page 3, line 30 through page 4, line 19 of the present specification, Applicant discloses:

SUMMARY OF THE INVENTION

This invention is directed to a new composition of matter comprising a hydride ion (H^-) having a binding energy greater than 0.8 eV, as reflected in the following formula

$$Binding\ Energy = \frac{\hbar^2 \sqrt{s(s+1)}}{8\mu_e a_0^2 \left[\frac{1 + \sqrt{s(s+1)}}{p} \right]^2} - \frac{\pi \mu_0 e^2 \hbar^2}{m_e^2 a_0^3} \left(1 + \frac{2^2}{\left[\frac{1 + \sqrt{s(s+1)}}{p} \right]^3} \right) \quad (1)$$

where p is an integer greater than one, $s = 1/2$, π is pi, \hbar is Planck's constant bar, μ_0 is the permeability of vacuum, m_e is the mass of the electron, μ_e is the reduced electron mass, a_0 is the Bohr radius, and e is the elementary charge. An ion comprising an ordinary hydrogen nucleus and two electrons having the binding energy of 0.8 eV is hereinafter referred to as "ordinary hydride ion." The hydride ion comprises two indistinguishable electrons bound to a proton. The hydride ion of the

present invention is formed by the reaction of an electron with a hydrogen atom having a binding energy given by

$$\text{Binding Energy} = \frac{13.6 \text{ eV}}{n^2} \quad (2)$$

where $n = \frac{1}{p}$ and p is an integer greater than one. (The binding energy is the energy required to remove an electron from an atom or a molecule and is equivalent to the ionization energy.) A hydrogen atom having the binding energy given in Eq. (2) is hereafter referred to as a hydrino atom or hydrino. The designation for a hydrino of radius $\frac{a_H}{p}$, where a_H is the radius of an ordinary hydrogen atom and p is an integer, is $H\left[\frac{a_H}{p}\right]$. A hydrogen atom with a radius a_H is hereinafter referred to as "ordinary hydrogen atom."

Hydrinos are formed by reacting an ordinary hydrogen atom with a catalyst having a net enthalpy of reaction of about

$$m \cdot 27.21 \text{ eV} \quad (3)$$

where m is an integer.

This catalysis releases energy with a commensurate decrease in size of the hydrogen atom, $r_n = na_H$. For example, the catalysis of $H(n=1)$ to $H(n=1/2)$ releases 40.8 eV , and the hydrogen radius decreases from a_H to $\frac{1}{2}a_H$. One such catalytic system involves potassium. The second ionization energy of potassium is 31.63 eV ; and K^+ releases 4.34 eV when it is reduced to K . The combination of reactions K^+ to K^{2+} and K^+ to K , then, has a net enthalpy of reaction of 27.28 eV , which is equivalent to $m=1$ in Eq. (3).

$$27.28 \text{ eV} + K^+ + K^+ + H\left[\frac{a_H}{p}\right] \rightarrow K + K^{2+} + H\left[\frac{a_H}{(p+1)}\right] + [(p+1)^2 - p^2] \times 13.6 \text{ eV} \quad (4)$$



The overall reaction is

$$H\left[\frac{a_H}{p}\right] \rightarrow H\left[\frac{a_H}{(p+1)}\right] + [(p+1)^2 - p^2] \times 13.6 \text{ eV} \quad (6)$$

Note that the energy given off during catalysis is much greater than the energy lost to the catalyst. The energy released is large as compared to conventional chemical reactions. For example, when hydrogen and oxygen gases undergo combustion to form water



the known enthalpy of formation of water is $\Delta H_f = -286 \text{ kJ / mole}$ or 1.48 eV per hydrogen atom. By contrast, each ($n = 1$) ordinary hydrogen atom undergoing catalysis releases a net of 40.8 eV . Moreover, further catalytic transitions may occur: $n = \frac{1}{2} \rightarrow \frac{1}{3}$, $\frac{1}{3} \rightarrow \frac{1}{4}$, $\frac{1}{4} \rightarrow \frac{1}{5}$, and so on. Once catalysis begins, hydrinos autocatalyze further in a process called disproportionation. This mechanism is similar to that of an inorganic ion catalysis. But, hydrino catalysis should have a higher reaction rate than that of the inorganic ion catalyst due to the better match of the enthalpy to $m \cdot 27.2 \text{ eV}$.

From R. L. Mills, P. Ray, "High Resolution Spectroscopic Observation of the Bound-Free Hyperfine Levels of a Novel Hydride Ion Corresponding to a Fractional Rydberg State of Atomic Hydrogen", Int. J. Hydrogen Energy, in press:

From a solution of a Schrodinger-type wave equation with a nonradiative boundary condition based on Maxwell's equations, Mills solves the hydrogen atom, the hydride ion, and predicts corresponding species having fractional principal quantum numbers. Atomic hydrogen may undergo a catalytic reaction with certain atomized elements and ions which singly or multiply ionize at integer multiples of the potential energy of atomic hydrogen, $m \cdot 27.2 \text{ eV}$ wherein m is an integer. The reaction involves a nonradiative energy transfer to form a hydrogen atom $H(1/p)$ that is lower in energy than unreacted atomic hydrogen that corresponds to a fractional principal quantum number ($n = \frac{1}{p} = \frac{1}{\text{integer}}$ replaces the well known parameter $n = \text{integer}$ in the Rydberg equation for hydrogen excited states). The ionization of Rb^+ and an electron transfer between two K^+ ions (K^+ / K^+) provide a reaction with a net enthalpy of 27.2 eV which serve as catalysts of atomic hydrogen to form $H(1/2)$. Intense extreme

ultraviolet (EUV) emission was observed from incandescently heated atomic hydrogen and each of atomized potassium and rubidium ions that generated a plasma called a resonance transfer or rt-plasma at low temperatures (e.g. $\approx 10^3$ K) and an extraordinary low field strength of about 1-2 V/cm. For further characterization, the width of the 6562 Å Balmer α line was recorded. Significant line broadening of 17 and 9 eV was observed from a rt-plasma of hydrogen with K^+ / K^+ and Rb^+ respectively. These results could not be explained by Stark or thermal broadening or electric field acceleration of charged species since the measured field of the incandescent heater was extremely weak, 1 V/cm, corresponding to a broadening of much less than 1 eV. Rather the source of the excessive line broadening is consistent with that of the observed EUV emission, an energetic reaction caused by a resonance energy transfer between hydrogen atoms and K^+ / K^+ or Rb^+ . The catalyst product $H(1/2)$ was predicted to be a highly reactive intermediate which further reacts to form a novel hydride ion $H^-(1/2)$. This hydride ion with a predicted binding energy of 3.0468 eV was observed by high-resolution visible spectroscopy as a broad peak at 4070.0 Å with a FWHM of 1.4 Å. From the electron g factor, bound-free hyperfine structure lines of $H^-(1/2)$ were predicted with energies E_{HF} given by $E_{HF} = j^2 3.0056 \times 10^{-5} + 3.0575$ eV (j is an integer) as an inverse Rydberg-type series that converges at increasing wavelengths and terminates at 3.0575 eV—the hydride spin-pairing energy plus the binding energy. The high-resolution visible plasma emission spectra in the region of 4000 Å to 4060 Å matched the predicted emission lines for $j = 1$ to $j = 37$ to 1 part in 10^5 .

THE SECRET COMMITTEE OFFERS NO EXPLANATION FOR THIS DATA OF LOWER-ENERGY HYDRIDE ION EMISSION AND EXTRAORDINARY PLASMA FORMATION GIVEN THE CONDITIONS, BUT RATHER, MERELY DISMISSES IT BASED ON A FLAWED THEORY.

From page 41, line 24 through page 43, line 23 of the present specification, Applicant discloses:

DIHYDRINO METHODS

The theoretical introduction to dihydrinos is provided in the '96 Mills GUT. Two hydrino atoms $H\left[\frac{a_H}{p}\right]$ may react to form a diatomic molecule referred to as a dihydrino $H_2^*\left[2c' = \frac{\sqrt{2}a_0}{p}\right]$.

$$2H\left[\frac{a_H}{p}\right] \rightarrow H_2^*\left[2c' = \frac{\sqrt{2}a_0}{p}\right] \quad (23)$$

where p is an integer. The dihydrino comprises a hydrogen molecule having a total energy, $E_T\left(H_2^*\left[2c' = \frac{\sqrt{2}a_0}{p}\right]\right)$,

$$E_T\left(H_2^*\left[2c' = \frac{\sqrt{2}a_0}{p}\right]\right) = -13.6 \text{ eV} \left[\left(2p^2\sqrt{2} - p^2\sqrt{2} + \frac{p^2\sqrt{2}}{2} \right) \ln \frac{\sqrt{2}+1}{\sqrt{2}-1} - p^2\sqrt{2} \right] \quad (24)$$

where $2c'$ is the internuclear distance and a_0 is the Bohr radius. Thus, the relative internuclear distances (sizes) of dihydrinos are fractional. Without considering the correction due to zero order vibration, the bond

dissociation energy, $E_D\left(H_2^*\left[2c' = \frac{\sqrt{2}a_0}{p}\right]\right)$, is given by the difference

between the energy of two hydrino atoms each given by the negative of Eq. (2) and the total energy of the dihydrino molecule given by Eq. (24). (The bond dissociation energy is defined as the energy required to break the bond).

$$E_T\left(H_2^*\left[2c' = \frac{2a_0}{p}\right]^+\right) = 13.6 \text{ eV} (-4p^2 \ln 3 + p^2 + 2p^2 \ln 3) \quad (26)$$

The first binding energy, BE_1 , of the dihydrino molecular ion with consideration of zero order vibration is about

$$BE_1 = \frac{16.4}{\left(\frac{1}{p}\right)^2} \text{ eV} \quad (26a)$$

Without considering the correction due to zero order vibration, the bond dissociation energy, $E_D \left[H_2^* \left[2c' = \frac{2a_e}{p} \right]^+ \right]$, is the difference between the negative of the binding energy of the corresponding hydrino atom given by Eq. (2) and $E_T \left[H_2^* \left[2c' = \frac{2a_e}{p} \right]^+ \right]$ given by Eq. (26).

$$E_D \left[H_2^* \left[2c' = \frac{2a_e}{p} \right]^+ \right] = E \left(H \left[\frac{a_H}{p} \right] \right) - E_T \left[H_2^* \left[2c' = \frac{2a_e}{p} \right]^+ \right] \quad (27)$$

The first binding energy, BE_1 , of the dihydrino molecule

$$H_2^* \left[2c' = \frac{\sqrt{2}a_e}{p} \right] \rightarrow H_2^* \left[2c' = \frac{2a_e}{p} \right]^+ + e^- \quad (28)$$

is given by Eq. (26) minus Eq. (24).

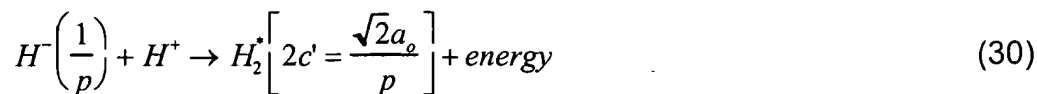
$$BE_1 = E_T \left[H_2^* \left[2c' = \frac{2a_e}{p} \right]^+ \right] - E_T \left[H_2^* \left[2c' = \frac{\sqrt{2}a_e}{p} \right] \right] \quad (29)$$

The second binding energy, BE_2 , is given by the negative of Eq. (26). The first binding energy, BE_1 , of the dihydrino molecule with consideration of zero order vibration is about

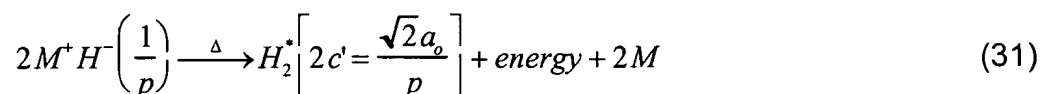
$$BE_1 = \frac{15.5}{\left(\frac{1}{p} \right)^2} \text{ eV} \quad (29a)$$

The dihydrino and the dihydrino ion are further described in the '96 Mills GUT, and PCT/US96/07949 and PCT/US/94/02219.

A method to prepare dihydrino gas from the hydrino hydride comprises reacting hydrino hydride with a source of protons including acid, protons of a plasma of a gas discharge cell, and protons from a metal hydride. The reaction of hydrino hydride $H^- \left(\frac{1}{p} \right)$ with a proton is

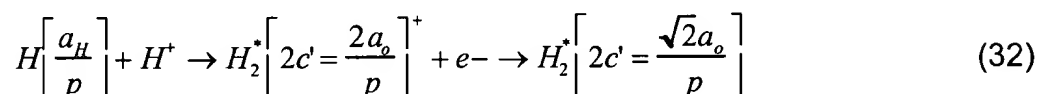


One way to make dihydrino gas from hydrino hydride is by thermally decomposing the hydride. For example, potassium hydrino hydride is heated until potassium metal is formed together with dihydrino gas. An example of a thermal decomposition reaction of hydrino hydride $M^+H^-\left(\frac{1}{p}\right)$ is



where M^+ is the cation.

A hydrino can react with a proton to form a dihydrino ion which further reacts with an electron to form a dihydrino molecule.



The energy of the reaction of the hydrino atom with a proton is given by the negative of the bond energy of the dihydrino ion (Eq. (27)). The energy given by the reduction of the dihydrino ion by an electron is the negative of the first binding energy (Eq. (29)). These reactions emit UV radiation. UV spectroscopy is a way to study the emitted radiation.

From R. Mills, P. Ray, "Vibrational Spectral Emission of Fractional-Principal-Quantum-Energy-Level Hydrogen Molecular Ion", *Int. J. Hydrogen Energy*, in press:

From a solution of a Schrodinger-type wave equation with a nonradiative boundary condition based on Maxwell's equations, Mills solves the hydrogen atom, the hydrogen molecular ion, the hydrogen molecule and predicts corresponding species having fractional principal quantum numbers. Atomic hydrogen may undergo a catalytic reaction with certain atomized elements and ions which singly or multiply ionize at integer multiples of the potential energy of atomic hydrogen, $m \cdot 27.2 \text{ eV}$ wherein m is an integer. The reaction involves a nonradiative energy transfer to form a hydrogen atom $H(1/p)$ that is lower in energy than unreacted atomic hydrogen that corresponds to a fractional principal

quantum number ($n = \frac{1}{p} = \frac{1}{\text{integer}}$ replaces the well known parameter $n = \text{integer}$ in the Rydberg equation for hydrogen excited states). One such atomic catalytic system involves argon ions. The reaction Ar^+ to Ar^{2+} has a net enthalpy of reaction of 27.63 eV , which is equivalent to $m = 1$. Thus, it may serve as a catalyst to form $H(1/2)$. Also, the second ionization energy of helium is 54.4 eV ; thus, the ionization reaction of He^+ to He^{2+} has a net enthalpy of reaction of 54.4 eV which is equivalent to $2 \cdot 27.2 \text{ eV}$. The products of the catalysis reaction $H(1/3)$ may further serve as catalysts to form $H(1/4)$ and $H(1/2)$. $H(1/p)$ may react with a proton to form an excited state molecular ion $H_2^+(1/p)^+$ that has a bond energy and vibrational levels that are p^2 times those of the molecular ion comprising uncatalyzed atomic hydrogen where p is an integer. Thus, the excited state spectrum of $H_2^+[n = 1/4; n^* = 2]^+$ was predicted to comprise rotationally broadened vibrational transitions at 1.185 eV increments to the dissociation limit of $H_2[n = 1/4]^+$, $E_D = 42.88 \text{ eV}$ (28.92 nm). Extreme ultraviolet (EUV) spectroscopy was recorded on microwave discharges of argon or helium with 10% hydrogen in the range $10 - 65 \text{ nm}$. Novel emission lines assigned to vibrational transitions of $H_2^+[n = 1/4; n^* = 2]^+$ were observed in this range with energies of $\nu \cdot 1.185 \text{ eV}$, $\nu = 17 \text{ to } 38$ that terminated at about 28.9 nm . In addition, fractional molecular hydrogen rotational transitions were assigned to previously unidentified lines in the solar coronal spectrum that matched theoretical predictions to five figures.

THE SECRET COMMITTEE OFFERS NO EXPLANATION WHICH COULD CHALLENGE THIS NEWLY SUBMITTED DATA OF LOWER-ENERGY HYDROGEN MOLECULAR ION EMISSION, BUT RATHER, MERELY DISMISSES IT BASED ON A FLAWED THEORY.

From page 3, line 30 through page 11, line 13 of the present specification, Applicant discloses:

SUMMARY OF THE INVENTION

This invention is directed to a new composition of matter comprising a hydride ion (H^-) having a binding energy greater than 0.8 eV , as reflected in the following formula

$$\text{Binding Energy} = \frac{\hbar^2 \sqrt{s(s+1)}}{8\mu_e a_0^2 \left[\frac{1 + \sqrt{s(s+1)}}{p} \right]^2} - \frac{\pi \mu_0 e^2 \hbar^2}{m_e^2 a_0^3} \left(1 + \frac{2^2}{\left[\frac{1 + \sqrt{s(s+1)}}{p} \right]^3} \right) \quad (1)$$

where p is an integer greater than one, $s = 1/2$, π is pi, \hbar is Planck's constant bar, μ_0 is the permeability of vacuum, m_e is the mass of the electron, μ_e is the reduced electron mass, a_0 is the Bohr radius, and e is the elementary charge. An ion comprising an ordinary hydrogen nucleus and two electrons having the binding energy of 0.8 eV is hereinafter referred to as "ordinary hydride ion." The hydride ion comprises two indistinguishable electrons bound to a proton. The hydride ion of the present invention is formed by the reaction of an electron with a hydrogen atom having a binding energy given by

$$\text{Binding Energy} = \frac{13.6 \text{ eV}}{n^2} \quad (2)$$

where $n = \frac{1}{p}$ and p is an integer greater than one. (The binding energy is the energy required to remove an electron from an atom or a molecule and is equivalent to the ionization energy.) A hydrogen atom having the binding energy given in Eq. (2) is hereinafter referred to as a hydrino atom or hydrino. The designation for a hydrino of radius $\frac{a_H}{p}$, where a_H is the radius of an ordinary hydrogen atom and p is an integer, is $H\left[\frac{a_H}{p}\right]$. A hydrogen atom with a radius a_H is hereinafter referred to as "ordinary hydrogen atom."

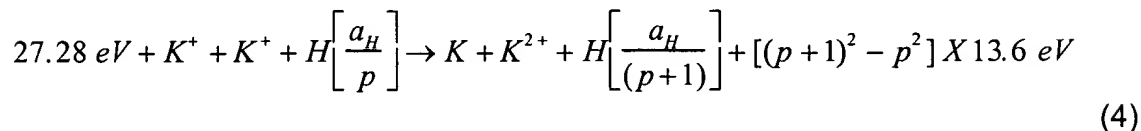
Hydrinos are formed by reacting an ordinary hydrogen atom with a catalyst having a net enthalpy of reaction of about

$$m \cdot 27.21 \text{ eV} \quad (3)$$

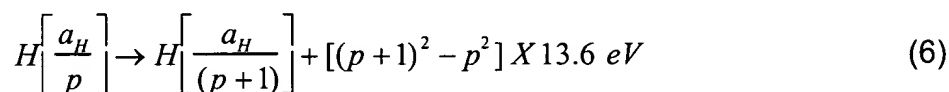
where m is an integer.

This catalysis releases energy with a commensurate decrease in size of the hydrogen atom, $r_n = n a_H$. For example, the catalysis of $H(n=1)$ to $H(n=1/2)$ releases 40.8 eV, and the hydrogen radius

decreases from a_H to $\frac{1}{2}a_H$. One such catalytic system involves potassium. The second ionization energy of potassium is 31.63 eV ; and K^+ releases 4.34 eV when it is reduced to K . The combination of reactions K^+ to K^{2+} and K^+ to K , then, has a net enthalpy of reaction of 27.28 eV , which is equivalent to $m = 1$ in Eq. (3).



The overall reaction is



Note that the energy given off during catalysis is much greater than the energy lost to the catalyst. The energy released is large as compared to conventional chemical reactions. For example, when hydrogen and oxygen gases undergo combustion to form water



the known enthalpy of formation of water is $\Delta H_f = -286 \text{ kJ / mole}$ or 1.48 eV per hydrogen atom. By contrast, each ($n = 1$) ordinary hydrogen atom undergoing catalysis releases a net of 40.8 eV . Moreover, further catalytic transitions may occur: $n = \frac{1}{2} \rightarrow \frac{1}{3}$, $\frac{1}{3} \rightarrow \frac{1}{4}$, $\frac{1}{4} \rightarrow \frac{1}{5}$, and so on. Once catalysis begins, hydrinos autocatalyze further in a process called disproportionation. This mechanism is similar to that of an inorganic ion catalysis. But, hydrino catalysis should have a higher reaction rate than that of the inorganic ion catalyst due to the better match of the enthalpy to $m \cdot 27.2 \text{ eV}$.

Hydrino $H\left[\frac{a_H}{p}\right]$ reacts with an electron to form a corresponding hydrino hydride ion, hereinafter designated as $H^-(n = 1 / p)$:



The binding energies of the hydrino hydride ion $H^-(n = 1/p)$ as a function of p , where p is an integer, are shown in TABLE 1.

TABLE 1. The representative binding energy of the hydrino hydride ion $H^-(n = 1/p)$ as a function of p , Eq. (1).

Hydride Ion	r_1 (a_0) ^a	Binding Energy ^b (eV)	Wavelength (nm)
$H^-(n = 1/2)$	0.9330	3.047	407
$H^-(n = 1/3)$	0.6220	6.610	188
$H^-(n = 1/4)$	0.4665	11.23	110
$H^-(n = 1/5)$	0.3732	16.70	74.2
$H^-(n = 1/6)$	0.3110	22.81	54.4
$H^-(n = 1/7)$	0.2666	29.34	42.3
$H^-(n = 1/8)$	0.2333	36.08	34.4
$H^-(n = 1/9)$	0.2073	42.83	28.9
$H^-(n = 1/10)$	0.1866	49.37	25.1
$H^-(n = 1/11)$	0.1696	55.49	22.3
$H^-(n = 1/12)$	0.1555	60.97	20.3
$H^-(n = 1/13)$	0.1435	65.62	18.9
$H^-(n = 1/14)$	0.1333	69.21	17.9
$H^-(n = 1/15)$	0.1244	71.53	17.3
$H^-(n = 1/16)$	0.1166	72.38	17.1

^a Equation (21)

^b Equation (22)

According to the present invention, a hydride ion (H^-) is provided having a binding energy greater than 0.8 eV. The binding energy, also known as the ionization energy, of an atom, ion or molecule is the energy required to remove one electron from the atom, ion or molecule. Hydride ions having a binding of about 3, 7, 11, 17, 23, 29, 36, 43, 49, 55, 61, 66, 69, 71 and 72 eV are provided.

According to another embodiment of the invention, a compound is provided, comprising at least one increased binding energy hydrogen

species. The increased binding energy hydrogen species is selected from the group consisting of (a) increased binding energy hydride ions having a binding energy greater than 0.8 eV, (b) increased binding energy hydrogen atoms having a binding energy of about $13.6/n^2$ eV, (c) increased binding energy hydrogen molecules having a first binding energy of about $15.5/n^2$ eV, and (d) increased binding energy molecular hydrogen ion having a binding energy of about $16.4/n^2$ eV. The variable "n" is a fraction whose numerator is 1 and denominator is an integer greater than 1.

The compound is preferably greater than 50 atomic percent pure. More preferably, the compound is greater than 90 atomic percent pure. Most preferably, the compound is greater than 98 atomic percent pure.

The compound may further comprise one or more cations, such as a proton or H_3^+ .

The compound may further comprise one or more normal hydrogen atoms and/or normal hydrogen molecules.

The compound may have the formula MH , MH_2 , or M_2H_2 , wherein M is an alkali cation and H is an increased binding energy hydride ion or an increased binding energy hydrogen atom. The compound may have the formula MH_n wherein n is 1 or 2, M is an alkaline earth cation and H is an increased binding energy hydride ion or an increased binding energy hydrogen atom.

The compound may have the formula MHX wherein M is an alkali cation, X is one of a neutral atom, a molecule, or a singly negatively charged anion, and H is an increased binding energy hydride ion or an increased binding energy hydrogen atom.

The compound may have the formula MHX wherein M is an alkaline earth cation, X is a singly negatively charged anion, and H is an increased binding energy hydride ion or an increased binding energy hydrogen atom.

The compound may have the formula MHX wherein M is an alkaline earth cation, X is a doubly negatively charged anion, and H is an increased binding energy hydrogen atom.

The compound may have the formula M_2HX wherein M is an alkali cation, X is a singly negatively charged anion, and H is an increased binding energy hydride ion or an increased binding energy hydrogen atom.

The compound may have the formula MH_n wherein n is an integer from 1 to 5, M is an alkaline cation and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula M_2H_n wherein n is an integer from 1 to 4, M is an alkaline earth cation and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula M_2XH_n wherein n is an integer from 1 to 3, M is an alkaline earth cation, X is a singly negatively charged anion, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula $M_2X_2H_n$ wherein n is 1 or 2, M is an alkaline earth cation, X is a singly negatively charged anion, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula M_2X_3H wherein M is an alkaline earth cation, X is a singly negatively charged anion, and H is an increased binding energy hydride ion or an increased binding energy hydrogen atom.

The compound may have the formula M_2XH_n wherein n is 1 or 2, M is an alkaline earth cation, X is a doubly negatively charged anion, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula $M_2XX'H$ wherein M is an alkaline earth cation, X is a singly negatively charged anion, X' is a doubly negatively charged anion, and H is an increased binding energy hydride ion or an increased binding energy hydrogen atom.

The compound may have the formula $MM'H_n$ wherein n is an integer from 1 to 3, M is an alkaline earth cation, M' is an alkali metal cation and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula $MM'XH_n$ wherein n is 1 or 2, M is an alkaline earth cation, M' is an alkali metal cation, X is a singly negatively charged anion and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula $MM'XH$ wherein M is an alkaline earth cation, M' is an alkali metal cation, X is a doubly negatively charged anion and H is an increased binding energy hydride ion or an increased binding energy hydrogen atom.

The compound may have the formula $MM'XX'H$ wherein M is an alkaline earth cation, M' is an alkali metal cation, X and X' are singly negatively charged anion and H is an increased binding energy hydride ion or an increased binding energy hydrogen atom.

The compound may have the formula H_nS wherein n is 1 or 2 and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula $MSiH_n$ wherein n is an integer from 1 to 6, M is an alkali or alkaline earth cation, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula $MXX'H_n$ wherein n is an integer from 1 to 5, M is an alkali or alkaline earth cation, X is a singly or doubly negatively charged anion, X' is Si, Al, Ni, a transition element, an inner transition element, or a rare earth element, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula $MAIH_n$ wherein n is an integer from 1 to 6, M is an alkali or alkaline earth cation and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula MH_n wherein n is an integer from 1 to 6, M is a transition element, an inner transition element, a rare earth element, or Ni, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula $MNiH_n$ wherein n is an integer from 1 to 6, M is an alkali cation, alkaline earth cation, silicon, or aluminum, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula MXH_n wherein n is an integer from 1 to 6, M is an alkali cation, alkaline earth cation, silicon, or aluminum, X is a transition element, inner transition element, or a rare earth element cation, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula $MSiH_n$ wherein n is an integer from 1 to 8, M is an alkali or alkaline earth cation, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula Si_2H_n wherein n is an integer from 1 to 8, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula SiH_n wherein n is an integer from 1 to 8, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula TiH_n wherein n is an integer from 1 to 4, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula Al_2H_n wherein n is an integer from 1 to 4, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula $MXAIX'H_n$ wherein n is 1 or 2, M is an alkali or alkaline earth cation, X and X' are either a singly negatively charged anion or a doubly negatively charged anion, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula $MXSiX'H_n$ wherein n is 1 or 2, M is an alkali or alkaline earth cation, X and X' are either a singly negatively charged anion or a doubly negatively charged anion, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula SiO_2H_n wherein n is an integer from 1 to 6, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula MSiO_2H_n wherein n is an integer from 1 to 6, M is an alkali or alkaline earth cation, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula MSi_2H_n wherein n is an integer from 1 to 6, M is an alkali or alkaline earth cation, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

The compound may have the formula M_2SiH_n wherein n is an integer from 1 to 8, M is an alkali or alkaline earth cation, and the hydrogen content H_n of the compound comprises at least one increased binding energy hydrogen species.

In MHX , M_2HX , M_2XH_n , $\text{M}_2\text{X}_2\text{H}_n$, $\text{M}_2\text{X}_3\text{H}$, $\text{M}_2\text{XX}'\text{H}$, $\text{MM}'\text{XH}_n$, $\text{MM}'\text{XX}'\text{H}$, $\text{MXX}'\text{H}_n$, $\text{MXAIX}'\text{H}_n$, the singly negatively charged anion may be a halogen ion, hydroxide ion, hydrogen carbonate ion, or nitrate ion.

In MHX , M_2XH_n , $\text{M}_2\text{XX}'\text{H}$, $\text{MM}'\text{XH}$, $\text{MXX}'\text{H}_n$, $\text{MXAIX}'\text{H}_n$, the doubly negatively charged anion may be a carbonate ion or sulfate ion.

From R. Mills, B. Dhandapani, M. Nansteel, J. He, T. Shannon, A. Echezuria, "Synthesis and Characterization of Novel Hydride Compounds", *Int. J. of Hydrogen Energy*, Vol. 26, No. 4, (2001), pp. 339-367:

Novel inorganic alkali and alkaline earth hydrides of the formula MHX and MHMX wherein M is the metal, X , is a singly negatively charged anion, and H comprises a novel high binding energy hydride ion were synthesized in a high temperature gas cell by reaction of atomic hydrogen with a catalyst and MX or MX_2 corresponding to an alkali metal or alkaline earth metal, respectively. It has been reported that intense extreme ultraviolet (EUV) emission was observed at low temperatures (e.g. $\approx 10^3 \text{ K}$) from atomic hydrogen and certain atomized elements or certain gaseous ions which ionize at integer multiples of the potential energy of atomic hydrogen, 27.2 eV [1-6]. These atomized elements or

certain gaseous ions comprised the catalyst to form *MHX* and *MHMX*. For example, atomic hydrogen was reacted with strontium vapor and $SrBr_2$ to form *SrHBr*. Novel hydride compounds such as *SrHBr* were identified by time of flight secondary ion mass spectroscopy, X-ray photoelectron spectroscopy, proton nuclear magnetic resonance spectroscopy, and thermal decomposition with analysis by gas chromatography, and mass spectroscopy. Hydride ions with increased binding energies form novel compounds with potential broad applications such as a high voltage battery for consumer electronics and electric vehicles. In addition, these novel compositions of matter and associated technologies may have far-reaching applications in many industries including chemical, electronics, computer, military, energy, and aerospace in the form of products such as propellants, solid fuels, surface coatings, structural materials, and chemical processes.

The Secret Committee offers no explanation for this data of novel lower-energy-hydrogen compounds, but rather, merely dismisses it based on a flawed theory and presents $\beta - Mg_2NiH_4$ as the prior art for the disclosed alkali and alkaline earth hydrides and halido hydrides. [See Section "IV.C.1" of this Response]

Much of the data provided is spectroscopic data.⁹⁰ The spectra from state-of-the-art instruments were provided for the Secret Committee's consideration. The Committee has presented no other explanation for the observed peaks. Only hydrogen and helium were present. Hydrogen has no peaks short of 78 nm, and the except for 30.4 nm, none of the 13 peaks identified by Applicant that are correspond to helium.

The Committee has not presented any plausible argument why any other laboratory would record a different spectrum than those provided by Applicant. For example, whether our commercial instrument records the spectrum of a helium plasma at Princeton, BlackLight's facility, or any other laboratory in the world, the instrument would be expected to be the perform identically. The spectral data stands on its own, and the Secret Committee is obligated to offer another explanation for the peaks or allow the patent to issue.

⁹⁰ Reference 21.

Extensive new data submitted to peer reviewed journals since the Mills Declaration was submitted has been is provided to the Secret Committee. For a summary and references, see Section "IV.B." of this Response.

Regarding presentations of Applicant's experimental data, each presentation, contrary to the Secret Committee's assertions, was independent and very scientifically sophisticated, requiring a significant effort on the part of each individual Ph.D. scientist to prepare and present. It is irreverent whether multiple presentations were given at any particular scientific meeting, or whether they all occurred at separate meetings. Furthermore, poster presentations are significant. Applicant and the 11 BlackLight Ph.D.'s have made 27 oral or poster presentations with more in progress. Tremendous effort and care went into these presentations.

In addition, Applicant gave two oral presentations and a poster presentation at the Fall 2001 National Meeting of the American Chemical Society:

1. R. Mills, "Novel catalytic reaction of hydrogen as a potential new energy source", Division of Industrial and Engineering Chemistry; Session: Industrial Bio-Based Technology, 222nd American Chemical Society Fall National Meeting, (August 26–30, 2001), Chicago, IL.
2. R. Mills, "Spectroscopic identification of a novel catalytic reaction of hydrogen", Division of Inorganic Chemistry; Session: Catalysis, 222nd American Chemical Society Fall National Meeting, (August 26–30, 2001), Chicago, IL.
2. R. Mills, "Spectroscopic identification of a novel catalytic reaction of hydrogen", Division of Physical Chemistry; Session: Physical Chemistry Poster Session, 222nd American Chemical Society Fall National Meeting, (August 26–30, 2001), Chicago, IL.

Dr. Ray gave an oral presentation at the recent 54th Annual Gaseous Electronics Conference of the American Physical Society Meeting:

P. Ray, R. Mills, "Spectroscopic identification of a novel catalytic reaction of hydrogen plasma", Session ET1: Lighting, American Physical Society Meeting, 54th Annual Gaseous Electronics Conference, October 9–12, 2001, Pennsylvania State University, State College, PA.

Dr. Dayalan will present an invited talk at the Long Beach Annual Battery Conference 2002, January 15–18, 2002, California State University at Long Beach, CA:

R. L. Mills, E. Dayalan, "Novel Alkali and Alkaline Earth Hydrides for High Voltage and High Energy Density Batteries", Proceedings of the 17th Annual Battery Conference on Applications and Advances, California State University, Long Beach, CA, (January 15-18, 2002), in press.

Applicant will be speaking at the upcoming National American Chemical Society Meeting in April, 2002.

Applicant will be speaking about his lower-energy hydrogen technology at the following six upcoming National American Chemical Society Meetings:

1. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Chandra, "Spectroscopic Identification of a Novel Catalytic Reaction of Hydrogen", Division of Inorganic Chemistry, Oral Presentation, 223rd ACS National Meeting, (April 7–11, 2002), Orlando, FL.
2. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Chandra, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Division of Inorganic Chemistry, Oral Presentation, 223rd ACS National Meeting, (April 7–11, 2002), Orlando, FL.
3. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Chandra, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Division of Industrial and Engineering Chemistry, Oral Presentation, 223rd ACS National Meeting, (April 7–11, 2002), Orlando, FL.
4. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Chandra, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Catalysis and Surface Science Secretariat, Oral Presentation, 223rd ACS National Meeting, (April 7–11, 2002), Orlando, FL.
5. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Chandra, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Division of Physical Chemistry, Poster

Presentation, 223rd ACS National Meeting, (April 7–11, 2002), Orlando, FL.

6. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Chandra, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Division of Physical Chemistry, Sci-Mix Poster Presentation, 223rd ACS National Meeting, (April 7–11, 2002), Orlando, FL.

Applicant will also be presenting his lower-energy hydrogen technology at the following conferences:

7. R. M. Mayo, R. L. Mills, M. Nansteel, "Direct Plasmadynamic Conversion of Plasma Thermal Power from a Novel Plasma Source to Electricity for Microdistributed Power Applications", 40th Power Sources Conference, (June 6–13, 2002), Cherry Hill, NJ.
8. R. L. Mills, E. Dayalan, "Novel Alkali and Alkaline Earth Hydrides for High Voltage and High Energy Density Batteries", Proceedings of the 17th Annual Battery Conference on Applications and Advances, California State University, Long Beach, CA, (January 15-18, 2002), in press.

Applicant gave the following presentation on his theory:

R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Global Foundation, Inc. Orbis Scientiae entitled *The Role of Attractive and Repulsive Gravitational Forces in Cosmic Acceleration of Particles The Origin of the Cosmic Gamma Ray Bursts*, (29th Conference on High Energy Physics and Cosmology Since 1964) Dr. Behram N. Kursunoglu, Chairman, December 14-17, 2000, Lago Mar Resort, Fort Lauderdale, FL.

Applicant's talk was published in the proceedings of that meeting:

R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Global Foundation, Inc. Orbis Scientiae entitled *The Role of Attractive and Repulsive Gravitational Forces in Cosmic Acceleration of Particles The Origin of the Cosmic Gamma Ray Bursts*, (29th Conference on High Energy Physics and Cosmology Since 1964) Dr. Behram N. Kursunoglu, Chairman, December 14-17, 2000, Lago Mar Resort, Fort Lauderdale, FL, Kluwer Academic/Plenum Publishers, New York, pp. 243-258.

Applicant was invited to submit a paper based on this presentation at the National Hydrogen Association Meeting that was published in the proceedings of the meeting:

R. Mills, "BlackLight Power Technology-A New Clean Hydrogen Energy Source with the Potential for Direct Conversion to Electricity", Proceedings of the National Hydrogen Association, 12 th Annual U.S. Hydrogen Meeting and Exposition, *Hydrogen: The Common Thread*, The Washington Hilton and Towers, Washington DC, (March 6-8, 2001), pp. 671-697.

Applicant gave a presentation on his process, novel compositions of matter, and power technologies, which were published in the proceedings of the meeting:

R. Mills, "BlackLight Power Technology-A New Clean Energy Source with the Potential for Direct Conversion to Electricity", Global Foundation International Conference on "Global Warming and Energy Policy", Dr. Behram N. Kursunoglu, Chairman, Fort Lauderdale, FL, November 26-28, 2000, Kluwer Academic/Plenum Publishers, New York, pp. 1059-1096.

Applicant has gone far beyond that which should be necessary to present his technology to the public. Like in so many issues, however, the Secret Committee has once again held Applicant to an unfair standard.

4. Applicant's response to Secret Committee's contention that "20. Calorimetric experiments purporting to demonstrate 'apparent excess heat' cannot be accepted uncritically"

Applicant agrees with the Secret Committee that an accurate calorimetric study of an electrolytic cell requires attention to recombination, heat gradients, careful measurements, etc. The Committee fails to realize, however, that Applicant has generated very substantial calorimetric data and uses many tests in addition to calorimetry to confirm the disclosed novel chemistry as summarized in Section "IV.B." of this Response.

5. Applicant's response to the Secret Committee's contention that "21. Applicant's calorimetric experimental data are not persuasive"

Applicant is struck by the Secret Committee's statement that the NASA group was receptive to the idea of "hydrinos." How does the Committee know this? In fact, the report was delayed for two years as strong opponents to "hydrinos" argued against the positive results.

In the NASA report,⁹¹ NASA Lewis tested a cell identical to that of Thermacore,⁹² with the exception that it was minus the central cathode. A cell identical to the test cell with heater power only (no electrolysis) was the calibration control and the blank cell with the heater power equal to zero. The test cell was also calibrated "on the fly" by measuring the temperature relative to the blank cell at several values of heater input power of the test cell. "Replication of experiments claiming to demonstrate excess heat production in light water-Ni-K₂CO₃ electrolytic cells was found to produce an apparent excess heat of 11 W maximum, for 60 W electrical power into the cell. Power gains ranged from 1.06 to 1.68." The production of excess energy with a power gain of 1.68 would require 0% Faraday efficiency to account for the observed excess power.

The Secret Committee should also know that Thermacore, Inc. is not Applicant's company. It is a well-respected heat transfer company, which is now a subsidiary of Modine, a multi-billion dollar heat management company. Thermacore's results were published⁹³ with data obtained at the same time at Applicant's company.

Specifically, calorimetry of pulsed current and continuous electrolysis of aqueous potassium carbonate (K⁺/K⁺ electrocatalytic couple) at a nickel cathode was performed by Thermacore. The excess power out of 41 watts exceeded the total input power given by the product of the electrolysis voltage and current by a factor greater than 8. Elemental analysis of the electrolyte and metallurgical analysis of the cathode showed

⁹¹ Reference 58.

⁹² Reference 47.

⁹³ Reference 47.

no evidence of chemical reactions. The pH, specific gravity, concentration of K_2CO_3 , and the elemental analysis of the electrolyte sample taken after 42 days of continuous operation were unchanged from that of the values obtained for the electrolyte sample taken before operation. Elemental analysis and scanning electron microscopy of metallurgical samples of the nickel cathode taken before operation and at day 56 of continuous operation were identical indicating that the nickel cathode had not changed chemically or physically. Scintillation counter and photographic film measurements showed that no radiation above background was detected indicating that nuclear reactions did not occur.

The product of the exothermic reaction is atoms having electrons of energy below the "ground state" which are predicted to form molecules. The predicted molecules were identified by lack of reactivity with oxygen, by separation from molecular deuterium by cryofiltration, and by mass spectroscopic analysis. The combustion of the gases evolved during the electrolysis of a light water K_2CO_3 electrolyte (K^+/K^+ electrocatalytic couple) with a nickel cathode was incomplete. The mass spectroscopic analysis of the $m/e = 2$ peak of the combusted gas demonstrated that the dihydrido molecule, $H_2(n = 1/2)$, has a higher ionization energy than H_2 .

Calorimetry of pulsed current and continuous electrolysis of aqueous potassium carbonate (K^+/K^+ electrocatalytic couple) at a nickel cathode was performed in single-cell dewar calorimetry cells by HydroCatalysis Power Corporation (now BlackLight Power, Inc.). Excess power out exceeded input power by a factor greater than 16. No excess heat was observed when the electrolyte was changed from potassium carbonate to the control sodium carbonate. The faraday efficiency was measured volumetrically to be 100%.

Thermacore measured more heat out than total input power by a factor greater than 8; thus, the heat could not have been due to recombination. The experiment was performed very carefully with temperature gradients eliminated by insuring adequate stirring which was checked. Proper measurement procedures were used. The

Thermacore cell was vented through a condenser to eliminate evaporative water losses. The Faraday efficiency was checked. From p. 115:

From the condensed evolving water vapor, the evaporative losses from Experiment # 4 were measured to be 6.5 ml per 24 hours, and 402 ml of water was added to the cell per 24 hours to maintain a constant fill level. The volume consumed by Faraday losses is calculated to be 403 ml. Thus, the evaporative and Faraday losses equaled the maintenance water volume to within 1%.

Their water add back rates were consistent with the cell being close to 100% Faraday efficient, which implies that NASA's results were not due to recombination. In fact, according to the NASA scientists: "Our sparse water addition data thus seems not to entirely favor the recombination explanation."⁹⁴

Since the Thermacore tests, Applicant has analyzed the electrolyte and has confirmed that novel hydride compounds were produced. The excess heat is corroborated by the isolation of novel inorganic hydride compounds such as $KH KHCO_3$ and KH following each of the electrolysis and plasma electrolysis of a K_2CO_3 electrolyte which comprised high binding energy hydride ions that were stable in water with their identification by methods such as (i) ToF-SIMS on $KH KHCO_3$ which showed inorganic hydride clusters $K[KH KHCO_3]^+$ and a negative ToF-SIMS dominated by hydride ion, (ii) X-ray photoelectron spectroscopy which showed novel peaks corresponding to high binding energy hydride ions, and (iii) proton nuclear magnetic resonance spectroscopy which showed upfield-shifted peaks corresponding to more diamagnetic, high-binding-energy hydride ions.⁹⁵

Recently, Applicant has performed high-resolution visible spectroscopy on plasma electrolysis cells. Further confirmation is given by the high-resolution visible spectroscopic observation from rt-plasmas and plasma electrolysis cells of the predicted

⁹⁴ Reference 58.

⁹⁵ References 8, 11, 41, 43 and 44.

$H^-(1/2)$ ion of hydrogen catalysis by each of K^+ / K^0 , Rb^+ , Cs , and Ar^+ at 407 nm corresponding to its predicted binding energy of 3.05 eV.⁹⁶

Independent tests were performed at Westinghouse Corporation that are given in a report: Peterson, S., H., Evaluation of Heat Production from Light Water Electrolysis Cells of HydroCatalysis Power Corporation, Report from Westinghouse STC, 1310 Beulah Road, Pittsburgh, PA, February 25, 1994. In this report, Westinghouse Electric Corporation reports that excess heat was observed during the electrolysis of aqueous potassium carbonate (K^+/K^0 electrocatalytic couple) where the electrolysis of aqueous sodium carbonate served as the control. The data of the temperature of the cell minus the ambient temperature shows that when potassium carbonate replaced sodium carbonate in the same cell with the same input electrolysis power, the potassium experiment was twice as hot as the sodium carbonate experiment for the duration of the experiment, one month. The net faraday efficiency of gas evolution was experimentally measured to be unity by weighing the experiment to determine that the expected rate of water consumption was observed. The output power exceeded the total input power.

The reason for the uncertainty in the comparison of the potassium (catalyst run) with the sodium (control run) was that the potassium cell temperature was so high that a large unaccounted for amount of heat was lost due to evaporation. The skepticism on the part of STC experts regarded whether a 55 eV peak observed in the low binding energy region of the XPS spectrum of the high purity nickel cathode was a predicted hydride peak or whether the peak was due to iron. The survey scan, which was not given to the STC experts until a later date, showed no iron peaks. And, it was later confirmed by ToF-SIMS that iron could not be the source of the novel peak observed.⁹⁷

Since these tests were performed, Applicant has amassed overwhelming evidence of lower-energy hydrogen as summarized in Section "IV.B." of this Response.

⁹⁶ References 2, 7, 10, 11, 17, 22, and 25.

⁹⁷ Reference 82.

Regarding the Weismann study referred to by the Secret Committee, it reports that calorimetry of continuous electrolysis of aqueous potassium carbonate (K^+/K^+ electrocatalytic couple) at a nickel cathode was performed in single-cell dewar calorimetry cell by Noninski at Brookhaven National Laboratory.⁹⁸ Dr. Weismann observed the experiment and reported the results to Dr. Walter Polansky of the U. S. Department of Energy. Dr. Weismann reports, "The claim is as follows. The temperature rise in the dewar is greater in the case of electrolysis as compared to using a resistor, even though the power dissipated is equal in both cases. According to Applicant's theory, this apparent 'excess power' is due to the fact that the electron in a hydrogen atom can 'decay' to stable subinteger quantum levels. **Dr. Noninski demonstrated this thermal effect at BNL.**" The observed rise in temperature for a given input power was twice as high comparing electrolysis versus heater power.

Wiesmann was cautious because he did not conduct the experiment himself; although, it was conducted in his laboratory at BNL. The results of the same experiment were published.⁹⁹ Dr. Noninski of the Laboratory for Electrochemistry of Renewed Electrode-Solution Interface (LEPGER) successfully reproduced the results of Mills and Kneizys¹⁰⁰ as a visiting professor at Franklin and Marshall College. A significant increase in temperature with every watt input, compared with the calibration experiment ($\approx 50\text{ }^\circ\text{C} / W$ versus $\approx 30\text{ }^\circ\text{C} / W$), was observed during the electrolysis of potassium carbonate. This effect was not observed when sodium carbonate was electrolyzed. No trivial explanation (in terms of chemical reactions, change in heat transfer properties, etc.) of this effect were found.

For these reasons, the Secret Committee should reconsider its unreasonable refusal to give proper weight to Applicant's calorimetric data.

⁹⁸ Reference 83.

⁹⁹ Reference 59.

¹⁰⁰ Reference 48.

6. Applicant's response to the Secret Committee's contention that "22. Accurate calorimetric experiment disproves applicant's thesis that apparent excess heat requires an explanation in terms of the postulated 'hydrino atom'"

The Secret Committee's reliance on a supposed "significant experiment" described by Shkedi et al. as a basis for dismissing Applicant's experimental observations of excess heat is totally misplaced.

It is not surprising that some researchers may make mistakes in attempting to perform any arbitrary experiment, including that of Applicant's. The cited experiment was not an identical copy of Applicant's experiment. Shkedi et al. did not fully follow Applicant's procedure. For example, Applicant discloses in Mills, R., Good, W., Shaubach, R., "Dihydrino Molecule Identification", Fusion Technology, Vol. 25, 103 (1994):

As usual in electrochemistry, measures were taken to avoid impurities in the system, especially organic substances. We note here the known problems with the reproducibility of the hydrogen overpotential which can be overcome only by ensuring the lowest possible level of impurities. The following procedures were applied in order to reproduce the excess heat effect. Before starting the experiment, the electrolysis dewar was cleaned with Alconox and 0.1 M nitric acid and rinsed thoroughly with distilled water to remove all organic contaminants. The Pt anode was mechanically scoured with steel wool, soaked overnight in concentrated HNO₃, and rinsed with distilled water. The nickel cathode was removed from its container with rubber gloves, and cut and folded in such a way that no organic substances were transferred to the nickel surface. The nickel cathode was dipped into the working solution under electrolysis current and never left in the working solution without electrolysis current.

Shkedi et al. did not follow this procedure. In fact, they did exactly that which was advised against. From Z. Shkedi, et al., "Calorimetry, excess heat, and Faraday efficiency in $Ni - H_2O$ electrolytic cells", Fusion Technology, Vol. 28, No. 4, November, (1995), pp. 1720-1731 (page 1722, 1st column):

The nickel coil assembly was cleaned by soaking it in acetone and methanol and was sintered at 1000°C for 2 hrs in an atmosphere of 95% argon/ H_2 at atmospheric pressure.

They also used different materials than those taught by Applicant. Applicant has found that sintered mesh type materials form a gas boundary layer that prevents the potassium ion catalyst which is in the electrolyte from contacting hydrogen atoms on the surface of the electrode. From Z. Shkedi, et al., "Calorimetry, excess heat, and Faraday efficiency in $Ni - H_2O$ electrolytic cells", Fusion Technology, Vol. 28, No. 4, November, (1995), pp. 1720-1731 (page 1722, 1st column):

Type B cathodes were made of Fibrex sintered nickel mesh (National Standard, 80% fiber/20% powder) rolled in two layers around the same nickel mandrel as in type A cathodes and secured with two turns of 1-mm nickel wire. Type B cathodes were not cleaned or sintered after assembly.

The Secret Committee states that the observation of recombination by Shkedi et al. implies that Faraday inefficiency may explain excess heat observed by NASA and others. It is important to keep in mind, however, that the cell design of Shkedi et al. was very different from that of NASA and Thermacore. It favored recombination and was in fact designed to recombine all of the gases as a closed calorimeter when operating in that mode. Even so, Tables I-IV of Shkedi et al. show a range of Faraday efficiencies from 73% to 99%. Whereas, 0% Faraday efficiency was required in order to explain away the NASA results. The Secret Committee offers no other plausible explanation for the 11 W of excess power observed by NASA.

In cases where Applicant was an advisor, Applicant has a 100% track record of independent laboratories reporting an effect. Many of the results of these laboratories could not be attributed to recombination since the observed power was greater than the total input such as:

Mills, R., Good, W., "Fractional Quantum Energy Levels of Hydrogen", Fusion Technology, Vol. 28, No. 4, November, (1995), pp. 1697-1719.

Excess power and heat were observed during the electrolysis of aqueous potassium carbonate. Flow calorimetry of pulsed current electrolysis of aqueous potassium carbonate at a nickel cathode was performed in a single-cell dewar. The average power out of 24.6 watts exceeded the average input power (voltage times current) of 4.73 watts by a factor greater than 5. The total input energy (integration of voltage times current) over the entire duration of the experiment was 5.72 MJ; whereas, the total output energy was 29.8 MJ. No excess heat was observed when the electrolyte was changed from potassium carbonate to sodium carbonate.

Mills, R., Good, W., Shaubach, R., "Dihydrino Molecule Identification", Fusion Technology, Vol. 25, 103 (1994).

Calorimetry of pulsed current and continuous electrolysis of aqueous potassium carbonate (K^+/K^+ electrocatalytic couple) at a nickel cathode was performed by Thermacore, Inc. The excess power out of 41 watts exceeded the total input power given by the product of the electrolysis voltage and current by a factor greater than 8. Elemental analysis of the electrolyte and metallurgical analysis of the cathode showed no evidence of chemical reactions. The pH, specific gravity, concentration of K_2CO_3 , and the elemental analysis of the electrolyte sample taken after 42 days of continuous operation were unchanged from that of the values obtained for the electrolyte sample taken before operation. Elemental analysis and scanning electron microscopy of metallurgical samples of the nickel cathode taken before operation and at day 56 of continuous operation were identical indicating that the nickel cathode had not changed chemically or physically. Scintillation counter and photographic film measurements showed that no radiation above background was detected indicating that nuclear reactions did not occur.

Calorimetry of pulsed current and continuous electrolysis of aqueous potassium carbonate (K^+/K^+ electrocatalytic couple) at a nickel cathode was performed in single cell dewar calorimetry cells by HydroCatalysis Power Corporation. Excess power out exceeded input power by a factor greater than 16. No excess heat was observed when the electrolyte was changed from potassium carbonate to the control sodium carbonate. The faraday efficiency was measured volumetrically to be 100%.

R. Mills and S. Kneizys, Fusion Technol. Vol. 20, 65 (1991).

Calorimetry of pulsed current and continuous electrolysis of aqueous potassium carbonate (K^+/K^+ electrocatalytic couple) at a nickel cathode was performed in single cell dewar calorimetry cells by Mills of Franklin and Marshall College and Kneizys of Ursinus College. Excess power out exceeded the input power by a factor greater than 37. No excess heat was observed when the electrolyte was changed from potassium carbonate to the control sodium carbonate.

Jacox, M. G., Watts, K. D., "The Search for Excess Heat in the Mills Electrolytic Cell", Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, 83415, January 7, 1993.

Idaho National Engineering Laboratory (INEL) operated a cell identical to that of Thermacore¹⁰¹ except that it was minus the central cathode and that the cell was wrapped in a one-inch layer of urethane foam insulation about the cylindrical surface. The cell was operated in a pulsed power mode. A current of 10 amperes was passed through the cell for 0.2 seconds followed by 0.8 seconds of zero current for the current cycle. The cell voltage was about 2.4 volts, for an average input power of 4.8 W. The electrolysis power average was 1.84 W, and the stirrer power was measured to be 0.3 W. Thus, the total average net input power was 2.14 W. The cell was operated at various resistance heater settings, and the temperature difference between the cell and the ambient as well as the heater power were measured. The results of the excess power as a function of cell temperature with the cell operating in the pulsed power mode at 1 Hz with a cell voltage of 2.4 volts, a peak current of 10 amperes, and a duty cycle of 20 % showed that the excess power is temperature dependent for pulsed power operation, and the maximum excess power was 18 W for an input electrolysis joule heating power of 2.14 W. Thus, the ratio of excess power to input electrolysis joule heating power was 850 %. INEL scientists constructed an electrolytic cell comprising a nickel cathode, a platinized titanium anode, and a 0.57 M K_2CO_3 electrolyte. The cell design appears in Appendix 1. The cell was operated in the environmental chamber in the INEL Battery Test Laboratory at constant current, and the heat was removed by forced air convection in two cases. In the first case, the air was circulated by the

¹⁰¹ Reference 47.

environmental chamber circulatory system alone. In the second case, an additional forced air fan was directed onto the cell. The cell was equipped with a water condenser, and the water addition to the cell due to electrolysis losses was measured. The data of the forced convection heat loss calorimetry experiments during the electrolysis of a 0.57 M K_2CO_3 electrolyte with the INEL cell showed that 13 W of excess power was produced. This excess power could not be attributed to recombination of the hydrogen and oxygen as indicated by the equivalence of the calculated and measured water balance.

Nesterov, S. B., Kryukov, A. P., Moscow Power Engineering Institute Affidavit, February, 26, 1993.

The Moscow Power Engineering Institute experiments showed 0.75 watts of heat output with only 0.3 watts of total power input (power = VI) during the electrolysis of an aqueous potassium carbonate electrolyte with a nickel foil cathode and a platinized titanium anode. Excess power over the total input on the order of 0.45 watts was produced reliably and continuously over a period of three months. Evaluation of the electrolyte after three months of operation showed no significant change in its density or molar concentration. The cell was disassembled and inspected after over one month of operation at 0.1 amperes. This inspection showed no visible signs of a reaction between the electrodes and the electrolyte. The cell was re-assembled and operated as before. Excess energy was produced for the three-month duration of the experiment. Scintillation counter measurements showed no signs of radiation external to the cell.

Haldeman, C. W., Savoye, G. W., Iseler, G. W., Clark, H. R., MIT Lincoln Laboratories Excess Energy Cell Final report ACC Project 174 (3), April 25, 1995.

During the electrolysis of aqueous potassium carbonate, researchers working at MIT Lincoln Laboratories observed long duration excess power of 1-5 watts with output/input ratios over 10 in some cases with respect to the cell input power reduced by the enthalpy of the generated gas. In these cases, the output was 1.5 to 4 times the integrated volt-ampere power input. Faraday efficiency was measured volumetrically by direct water displacement.

Excess heat was also observed in a closed cell:

**Craw-Ivanco, M. T.; Tremblay, R. P.; Boniface, H. A.; Hilborn, J. W.;
"Calorimetry for a Ni/K₂CO₃ Cell", Atomic Energy Canada Limited,
Chemical Engineering Branch, Chalk River Laboratories, Chalk River,
Ontario, June 1994.**

Atomic Energy Canada Limited, Chalk River Laboratories, report that 128 % and 138% excess heat were observed in separate experiments by flow calorimetry during the electrolysis of aqueous potassium carbonate (K⁺/K⁺ electrocatalytic couple) in a closed cell, and that 138% was observed in an open cell.

Since these electrolysis experiments, Applicant has advanced to plasma cells, which produce a power density as high as 1000 times that achieved in the electrolysis cells. In this case, the calorimetry is trivial. A summary of equivocal measurement of power is given in Section "IV.B." of this Response. Line broadening, electron temperature, high energy spectroscopic lines corresponding to lower-energy hydrogen species and the analysis and characterization of the novel hydrogen products confirm the calorimetry as given in Section "IV.B." of this Response. In addition, a plasma was observed when all power has been removed from the cell that lasted for a time that was 1000 times the typical plasma decay time which proves a new energy source.¹⁰²

The time has come for the Secret Committee to acknowledge this vast body of experimental evidence, including Applicant's calorimetric data, and allow the subject application to issue as a patent.

**7. Applicant's response to the Secret Committee's
contention that "23. The Phillips Declaration with respect
to 'hydrino' formation in a calorimeter lacks probative value"**

The Secret Committee's criticism of the Phillips Declaration based on a document from EarthTech, Inc., Applicant's competitor, is completely unfounded.

¹⁰² Reference 1, 36, and 37.

Phillips' results are given in a report:

Phillips, J., Smith, J., Kurtz, S., "Report On Calorimetric Investigations Of Gas-Phase Catalyzed Hydrino Formation" Final report for Period October-December 1996", January 1, 1997, A Confidential Report submitted to BlackLight Power, Inc. provided by BlackLight Power, Inc., Great Valley Corporate Center, 41 Great Valley Parkway, Malvern, PA 19355.

Pennsylvania State University Chemical Engineering Department has determined heat production associated with hydrino formation with a Calvet calorimeter which yielded exceptional results. Specifically, the results are completely consistent with Mills' hydrino formation hypothesis. In three separate trials, between 10 and 20 K Joules were generated at a rate of 0.5 Watts, upon admission of approximately 10^{-3} moles of hydrogen to the 20 cm^3 Calvet cell containing a heated platinum filament and KNO_3 powder. This is equivalent to the generation of $10^7 J/mole$ of hydrogen, as compared to $2.5 \times 10^5 J/mole$ of hydrogen anticipated for standard hydrogen combustion. Thus, the total heats generated appear to be 100 times too large to be explained by conventional chemistry, but the results are completely consistent with Mills' model.

The Secret Committee improperly dismisses the Phillips data by misinterpreting the referenced EarthTech document. First of all, Earth Tech is a competitor that Applicant believes is adversarial. It is therefore possible that they have provided misinformation.

Furthermore, Applicant was unaware of the incorrect specifications sourced to EarthTech by the Secret Committee. However, on inspection of the document: "EarthTech's campaign to replicate one of the BlackLight Power excess heat results", on page 3, of the "BLP gas phase replication effort-Run 13" Applicant reads "**our** [emphasis added] detection limit for excess should be put at about 1 or 2 watts." Thus, it appears that the Secret Committee carelessly erred in applying the specifications of EarthTech's instrument to the interpretation of Phillips' data.

Dr. Phillips' expert technical capability is established in his Declaration. [See Sections 1, 2, and 3] Clearly, a person of his stature and knowledge would not make statements beyond the capability of the instrument. In fact, Phillips has published several peer-reviewed papers using this calorimeter. For example, a description of the

calorimeter is in Dr. Phillips's paper entitled, "High-temperature Calvet-type calorimeter for Investigating water reactions", Review of Scientific Instruments, Vol. 66 (1), January, 1995. In this paper the calorimeter is calibrated, see Figure 4, and the calorimeter demonstrated the ability to measure tenths of joules.

In Dr. Phillips' affidavit, the energy measured from BLP materials was stated as 31,000 joules. The energy reported in the affidavit is greater than 100 times the signal to noise for the instrument. In addition, the January 1996 report contains two finger tests that were performed prior to experimentation, see figures 21-1 and 22-1. These finger tests clearly demonstrate the signal to noise characteristics of the instrument. In the same report the energy balance is stated to hundredths of joules for the experiments, providing further guidance to the sensitivity of the instrument.

Thus, the Secret Committee's rejection of the Declaration from Dr. Phillips, who is a Distinguished National Laboratory Professor at the University of New Mexico, Department of Chemical and Nuclear Engineering, and a scientist at Los Alamos National Laboratory, based on improper information from a third-party competitor or a careless error is shown to be erroneous.

The Committee should also be made aware that EarthTech promotes "infinite energy from vacuum" which Applicant finds incredulous. Further, Applicant was contacted by Scott Little of EarthTech under the following pretext:

Scott Little Email of 3/2/99:

Although it would appear that you have sufficient funding and business structure in place, we are in a position to bring to the table essentially unlimited financial resources from a private investor with excellent connections in the international community. We consider this one of our most valuable resources with regard to a smooth transition to a new energy economy.

Scott R. Little
Harold E. Puthoff

Puthoff is a promoter of "infinite energy from the vacuum," which he claims can be used for power generation, space propulsion, as well as explain the stability of the

hydrogen atom. He is also the President/CEO of EarthTech International, Inc. The following is a sampling of his publications:

Puthoff, H.E., "THE ENERGETIC VACUUM: IMPLICATIONS FOR ENERGY RESEARCH" Speculations in Science and Technology, vol. 13, no. 4, pp. 247-257, 1990.

Puthoff, H.E., "Gravity as a Zero-Point-Fluctuation Force", Physical Review A, vol. 39, no. 5, pp. 2333-2342, 1 March 1989.

Puthoff, H.E., "Source of Vacuum Electromagnetic Zero-Point Energy," Physical Review A, vol. 40, no. 9, pp. 4857-4862, 1 November 1989.

Puthoff, H.E., Review A, vol. 44, no. 5, page 3382 and 3385-3386, and an Erratum in Physical Review A, vol. 41, no. 5, page 2902.

Puthoff, H.E., "Everything for Nothing", New Scientist, pp. 52-55, 28 July 1990.

Puthoff, H.E. , "Everything for Nothing"
<http://www.newphys.se/elektromagnum/physics/Puthoff/Everything%20for%20Nothing>

Puthoff, H.E., "Can the Vacuum be Engineered for Spaceflight applications?" <http://www.keelynet.com/gravity/putnasa.htm>.

Puthoff, H.E. (1987) "Ground state of hydrogen as a zero-point-fluctuation determined state", Phys. Rev. D, Vol. 35, No. 10, pp. 3266-3269.

See also, Interview with possible Roswell witness on 07 January 1993 by H.E. Puthoff, Institute of Advanced Studies, Austin, TX
<http://www.ufomind.com/misc/1997/jul/d26-001.shtml>

Finally, the Secret Committee's reference to the lack of success with the water bath calorimeter is indeed positive evidence of the catalysis mechanism. The catalysts condensed on the cold walls and was not operative according to Applicant's expectations. This explanation was also offered by Dr. Phillips.

In addition to Applicant's calorimetric data, Applicant has now conclusively shown experimentally that the disclosed lower-energy hydrogen exists with the same spectroscopy upon which quantum mechanics was initially based in its infancy before its

deviation from the physical world into other imaged dimensions and virtual particles. Applicant's spectroscopic data must be treated with the same respect and judged by the same standards. In addition to spectroscopy, Applicant has confirmed these lower-energy states by an exhaustive array of other test data.

Applicant therefore calls on the Secret Committee to cease its unfair attacks on that data and allow the subject application to issue as a patent.

V. The PTO's Actions to Date, Including Its Refusal to Fairly Consider the Submitted Evidence, Demonstrates Its Continued Bias Against Applicant

The Secret Committee's refusal to fairly consider the compelling experimental evidence of record is hardly surprising given certain events that have transpired since the PTO instituted withdrawal proceedings against BlackLight's five other allowed applications.

A. Secret Committee's Refusal to Give Proper Weight to Applicant's Spectroscopic Data

The Secret Committee's bias against Applicant is particularly self-evident in the way it has handled his extremely reliable spectroscopic data. The Committee is quick to ignore or dismiss that data when used by Applicant to show that new lower-energy states of hydrogen do, in fact, exist, but does not hesitate to rely on such data when it suits its purpose to support its competing quantum theory.

To fully appreciate the hypocrisy of the Committee's actions, one need look no further than the March 22, 2000 Decision that upheld the withdrawal procedure used to pull BlackLight's co-pending 09/009,294 application from issue. The PTO rationalized its Decision, in part, on a *Washington Post* article by Dr. Robert Park, Spokesman for Applicant's competitor, the American Physical Society:¹⁰³

While petitioner in the accompanying letter points to favorable testimonials from scientists and entrepreneurs regarding the "revolutionary technology" that the instant application is asserted to embody, this does not establish that either the Director, Technology Center 1700, or the

¹⁰³ This is the same Dr. Park who is reported to have a "Deep Throat" contact in the PTO with access to information regarding BlackLight's applications. [See supra, Section "III" of this Response]

Director, Special Programs Law Office, committed reversible error, nor that the Notice should be withdrawn. In contrast, mainstream newspapers have reported this same “revolutionary technology” is accompanied by controversy in the scientific community. See Baard et al., Scientists and entrepreneurs have lots of ideas about new sources of energy; some may even be practical, Wall St. J., Sept. 13, 1999, at R16; **Park, Perpetual motion; still going around, Washington Post, Jan. 12, 2000, at H3.** [March 22 Decision at 7]

Ironically, the PTO cited Dr. Park’s January 12, 2000 article to support its withdrawal action, which occurred only a month later on February 17, based on the following statements contained therein:

The energy states of atoms are studied through their atomic spectra—light emitted at very specific wavelengths when electrons make a jump from one energy level to another. The exact prediction of the hydrogen spectrum was one of the first great triumphs of quantum theory; it is the platform on which our entire understanding of atomic physics is built. The theory accounts perfectly for every spectral line.¹⁰⁴

There is no line corresponding to a “hydrino” state. Indeed there is no credible evidence at all to support Mills’ claim. [See Attachment 67]

That the PTO would rely on any BlackLight competitor to “bad-mouth” its technology is indefensible. That it chose to use Dr. Park of all people, who is renowned for conducting “hatchet jobs” on new technologies that threaten federal funding for the physicists he represents, is simply unforgivable.

Even the same *Washington Post* that ran Dr. Park’s libelous article rebuked its less than credible author in a subsequent article that confirmed his reputation for engaging in what it described a “search-and-destroy mission” against inventors and scientists who seek to advance the bounds of science. [See Article dated June 25, 2000 (Attachment 68)] To quote the article’s exact words, “Park’s anger permeates his rebuttals, which border on character assassination.” Noting that “thoroughness is not

¹⁰⁴ See the discussion in Applicant’s attached Appendix, addressing Dr. Park’s fallacies regarding the hydrogen spectrum, which was known well before any supposed “triumph” of quantum theory, and further exposing the failure of quantum theory to predict major features of that spectrum, including the spin splitting lines of hydrogen, the Lamb shift, the anomalous magnetic moment, etc.

Park's strong suit," the article goes on to suggest that his intentions may be less than honorable:

Park's failure to gather first-hand data is unfortunate, but his selective omissions are far more serious. In at least one case, he violated basic principles of journalism and science itself by apparently suppressing information that conflicts with his foregone conclusion. . . . Such tactics are reminiscent of the behavior of a zealous DA who is so convinced that a suspect is guilty that he feels entitled to withhold some information from the jury.

Dr. Park's competitive motives in refusing BlackLight's overtures to consider its evidence establishing lower-energy states of hydrogen are clear, as further recognized by the *Post* article in its description of Dr. Park as "a Washington lobbyist and PR flack for the American Physical Society." The article goes on to warn of the serious effects a rush to judgment can have without first-hand review of experimental evidence:

This is a serious matter, since even poorly documented vitriol can jeopardize a scientist's reputation and future funding if it is disseminated with the complicity of a respected organization such as the American Physical Society.

The incredible irony here cannot be easily overlooked. There is no question that the "vitriol" espoused by Dr. Park in his cited *Post* article has been, at least, partially responsible for the PTO's actions in withdrawing Applicant's five other allowed applications from issue, which actions effectively resulted in the present Final Action and identical 68-page Attachment. And yet, despite the fact that the very article the PTO relies upon to deny Applicant his patent recognizes that spectroscopic data is extraordinarily reliable—indeed, the "platform on which our entire understanding of atomic physics is built"—it nonetheless cavalierly ignores or dismisses that same data when submitted by Applicant to suit its own ulterior motives.

Applicant can think of no more clear bias than that.

**B. The February 21 Interview Provided Insight Into
the Secret Committee's Clear Bias Against Applicant**

Applicant got a hint of the treatment to expect from the Secret Committee during the February 21 Interview of BlackLight's pending applications, during which Examiner Jagannathan articulated several shocking positions on the Committee's behalf. For instance, Applicant presented some of the same experimental evidence discussed herein, generated by highly-respected independent laboratories, universities, and government agencies, that reaffirmed the existence of lower-energy hydrogen. Despite the reliability of this evidence, Examiner Jagannathan refused to even discuss its merits, but rather, indicated only that he would be persuaded by evidence "published" in peer-reviewed journals.¹⁰⁵

Although Examiner Jagannathan attempted to impose an improper standard—this being but one example—Applicant nonetheless submitted in his previous Response numerous published articles in esteemed publications, including the *International Journal of Hydrogen Energy* and the *IEEE Transactions on Plasma Science*. Having done so, Applicant is astonished that the Secret Committee now invents new excuses for not accepting this published data. [See *supra*, Section "IV." of this Response]

Examiner Jagannathan's reaction at the Interview to Applicant's spectroscopic data that conclusively confirmed the operability and enablement of the claimed inventions was even more astonishing. Examiner Jagannathan could not provide any cogent reasons as to why the experimental evidence did not demonstrate the existence of lower-energy hydrogen, only his misplaced belief that the spectroscopic data was "a bunch of squiggly lines" that could not be interpreted.

Such comments make clear that Examiner Jagannathan is either insufficiently qualified to interpret the spectroscopic data submitted by Applicant, or that his bias against Applicant is so strong, he is incapable of fairly interpreting that data.¹⁰⁶ This

¹⁰⁵ Counsel noted that such a standard would be tantamount to requiring Applicant to allow his competition—the physicists who review these articles—to be involved in prosecuting BlackLight's applications.

¹⁰⁶ During the Interview, Applicant requested that Examiner Jagannathan confer with a competent

experimental evidence was prepared using state-of-the-art equipment and, contrary to Examiner Jagannathan's disparaging comments, is capable of highly reliable interpretation by skilled scientists.

Applicant was also taken aback by Examiner Jagannathan's reaction not just to the quality of the experimental data presented at the Interview, but the quantity of that data as well, particularly his request that Applicant "not pile on the evidence."¹⁰⁷ Remarks like these leave Applicant wondering what it will take to ever convince Examiner Jagannathan and the rest of his fellow Secret Committee members of the merits of Applicant's claimed invention, assuming that is even a possibility.

Applicant has gone to considerable lengths and expense to collect experimental evidence that should have rebutted the rejections of record and convinced the Secret Committee to allow the subject application to issue. As discussed above, this experimental evidence is not merely cumulative, but demonstrates the operability and enablement of the claimed invention by many different well-known and reliable experimental techniques.

Applicant is entitled to have all of that evidence fairly considered and evaluated by competent PTO personnel.¹⁰⁸ Unfortunately, Examiner Jagannathan has provided

chemist who understands basic concepts of spectroscopic analysis, such as Examiners Langel and Kalafut.

¹⁰⁷ To Applicant's disappointment, Examiner Jagannathan would not allow him to complete his presentation of over 140 slides, which included third-party experimental evidence demonstrating the existence of lower-energy states of hydrogen.

¹⁰⁸ Other questionable comments by Examiner Jagannathan, demonstrating a lack of understanding of basic chemistry, raise concerns. One such comment, that the reaction of two potassium ions and a hydrogen atom was impossible because it was a three-body collision, is particularly disturbing. Any skilled chemist should readily understand that three-body collisions can and do occur, although less frequently than two-body collisions. The subject application recognizes as much in disclosing that the catalytic process operates faster when it involves binary collision reactions, as compared to tertiary collision reactions.

Examiner Jagannathan further argued that the disclosed catalytic reactions were impossible because a hydrogen atom would not "know" with which potassium ion of an identical pair to react. As pointed out during the Interview, that argument makes no sense whatsoever since it would preclude all symmetrical molecular reactions, which-type reactions are well known by chemists. For example, water molecules are symmetrical and, thus, according to the Examiner's argument, water should not exist since the oxygen atom would not "know" with which hydrogen atom to react first.

no indication of a willingness to do so, as has the rest of the Secret Committee judging by the baseless grounds of rejection presented in its Final Rejection.

C. The PTO's Statutory and Procedural Violations

Another indication of the extreme bias that has been directed against Applicant is the PTO's willingness to violate well-established statutes, as well as its own procedural guidelines, in its zeal to attack BlackLight. It is one thing for the PTO to vigorously enforce the rigid standards for patentability to which all patent applicants must abide. It is quite another for the PTO to ignore its own standards of conduct designed to protect the integrity of the examination process itself.

To be sure, Applicant fully expected that, like any pioneering technology, his novel hydrogen chemistry would be carefully scrutinized by the PTO during the application process. Indeed, the two highly-qualified Examiners originally assigned to review BlackLight's applications, Wayne Langel and Stephen Kalafut, conducted a thorough examination, initially questioning the operability of the disclosed technology on several grounds. Upon critical review of Applicant's supporting experimental evidence, however, the examiners issued the '935 patent drawn to an energy cell and allowed the five other chemical composition related applications, that were subsequently withdrawn from issue.¹⁰⁹

The PTO, however, unexpectedly justified its unlawful withdrawal and subsequent reexamination of BlackLight's applications by denigrating these fine examiners, while undercutting the statutory presumption of validity under 35 U.S.C. § 282 that has attached to U.S. patents for almost 50 years:

Presumption of validity; defenses

A patent shall be presumed valid. Each claim of a patent (whether in independent, dependent, or multiple dependent form) shall be presumed

¹⁰⁹ Examiners Langel and Kalafut displayed the utmost professionalism and courtesy in their initial prosecution of BlackLight's applications and are to be commended for their actions.

valid independently of the validity of other claims; dependent or multiple dependent claims shall be presumed valid even though dependent upon an invalid claim. The burden of establishing invalidity of a patent or any claim thereof shall rest on the party asserting such invalidity.

Underlying this statutory provision is the premise of administrative regularity, which presumes that well-trained examiners with expertise in their respective fields will properly carry out their examination duties by issuing only valid patents. See, e.g., American Hoist & Derrick Co. v. Sowa & Sons, Inc., 725 F.2d 1350, 1359 (Fed. Cir. 1984). This presumption was, in fact, confirmed by the capable work Examiners Langel and Kalafut performed in examining and issuing Applicant's '935 patent, as well as by their allowance of this and other withdrawn applications.¹¹⁰

Yet for some explained reason, Associate Solicitor Kevin Baer, speaking on behalf of the PTO, attacked BlackLight, and indirectly its own examining corps, by stating in open court:

"[P]atent examiners do review [patent applications]. Unfortunately, patent examiners are swamped and sometimes things slip through." [*BlackLight Power, Inc. v. Q. Todd Dickinson*, May 22, 2000 Tr. at 7 (Attachment 54 at Tab A)]

"[E]xaminers are under tremendous pressure to produce work, and if they're going to approve [an application], they just approve it and kind of let it out the door." [May 22, 2000 Tr. at 48 (Attachment 54 at Tab A)]

Solicitor Baer's statements on behalf of the PTO should be alarming to just about everyone—with the possible exception of accused patent infringers—and most certainly do not reflect well on an agency charged with maintaining the reliability of the patent system.

The PTO further violated its own procedural guidelines in another attempt to undermine Applicant. According to M.P.E.P. § 1701, "[p]ublic policy demands that every employee of the [Patent Office] refuse to express to any person any opinion as to

¹¹⁰ The Examiners initially rejected all claims in these cases, but after conducting five lengthy personal interviews with Applicant and carefully considering Applicant's experimental evidence, they ultimately allowed those claims.

the validity or invalidity of . . . any U.S. patent” With the exception of exclusions that do not apply, “[t]he question of validity or invalidity is otherwise exclusively a matter to be determined by a court. Members of the patent examining corps are cautioned to be especially wary of any inquiry from any person outside the [Patent Office], including an employee of another Government agency, the answer to which might indicate that a particular patent should not have issued.” The PTO clearly violated this admonition when it publicly disparaged the ‘935 patent on the record in its case against BlackLight.

In yet another blatant violation of this PTO rule, Solicitor John Whealan responded to a reporter’s inquiry for a soon-to-be published article by suggesting that “the PTO issued BlackLight’s ‘935 patent by mistake.” [See Attachment 66] That statement is a blatant mischaracterization of the facts and is but one more example of the utter contempt and hostility Applicant has had to face during the current secret examination of his applications. Solicitor Whealan should know full well that Applicant’s ‘935 patent was properly issued after a lengthy and thorough examination, which included a fair and honest consideration of Applicant’s experimental evidence—actions that seem to have escaped the Secret Committee in this proceeding.¹¹¹

These and other such incidents beg the question: What could possibly have motivated the PTO to conduct itself with such total disregard for the rules and laws governing its authority just to attack this one Applicant? Unfortunately, like the other questions about the facts and circumstances surrounding the PTO’s withdrawal action and subsequent secret examination of BlackLight’s applications, this one too simply goes unanswered.

**D. The PTO Improperly Made the
Pending July 20 Office Action Final**

Applicant timely filed a Petition to withdraw the premature finality of the Secret Committee’s July 20 Office Action, as it introduced new substantive grounds of rejection

¹¹¹ This is not the first time Solicitor Whealan has gotten his facts wrong. A review of the transcript from the oral argument in BlackLight’s Federal Circuit appeal, which Solicitor Whealan argued on behalf of the PTO, reveals numerous instances in which the Court confronted him with factual misstatements that indicated his lack of familiarity with the record.

that were neither necessitated by amendment of the claims, nor based on information submitted in an information disclosure statement. The Petition refers to Applicant's prior March 12, 2001 Response to the Committee's first Office Action, dated September 11, 2000, rejecting all claims under 35 U.S.C. §§ 101 and 112, in which he noted several deficiencies in that Office Action without amending the claims. Included among those deficiencies was the Secret Committee's failure to properly consider the experimental evidence already made of record and its failure to adequately address supposed shortcomings in Applicant's theory underlying his claimed invention.

The Petition further noted the Secret Committee's attempt—unsuccessful though it was—to overcome those deficiencies in the pending July 20 Final Office Action. Applicant provided specific examples demonstrating how, in that action, the Committee unfairly raised several new substantive grounds of rejection by addressing for the very first time record evidence and other previously submitted technical information that should have been considered and addressed in its first Office Action. Applicant further cited numerous examples of new state-of-the-art books and journals that were relied upon by the Secret Committee and newly-minted arguments that also could have and should have been presented earlier so as to develop a clear issue prior to appeal.

The improper finality of the pending July 20 Office Action is but another example of the abuse Applicant has suffered at the hands of the Secret Committee.¹¹²

E. Other Actions Evidencing PTO Bias

Unfortunately, the PTO's unlawful withdrawal action and hostile examination of BlackLight's applications are not isolated incidents. The very same week those applications were pulled, the PTO suspiciously transferred another allowable, unrelated

¹¹² Adding insult to injury, the Decision denying Applicant's Petition failed to even consider the grounds upon which the Petition was filed. That inaction formed the basis for Applicant's Request for Reconsideration of that Decision, which was filed in just one of Applicant's co-pending cases, the '294 application, to get an indication of the PTO's position prior to filing reconsideration requests in all cases. [See Attachment 69] Not surprisingly, the PTO has failed to consider that Request, which was submitted over six weeks ago.

application (U.S. App'n No. 09/220,970) to a new Examiner, Bijan Tadayon, who summarily rejected all the claims.

That application, relating to pattern recognition, had been previously reviewed by the original Examiner and a Section 101 panel of senior Examiners, all of whom found the claimed subject matter allowable. Despite that fact, the new Examiner Tadayon rejected the application, again in a hostile manner, alleging vague deficiencies under 35 U.S.C. §§ 101 and 112, first paragraph, similar to allegations presented in the subject application.

In another disturbing coincidence, Examiner Tadayon admitted during an Interview that he was not the examiner responsible for introducing the new rejections. Thus, it would appear that the use of Secret Committees to covertly examine Applicant's patent applications is not confined to the subject application.¹¹³

¹¹³ See relevant parts of Applicant's Appeal Brief filed in the '970 application, providing further details of PTO hostility shown towards Applicant. [Attachment 56]